DOCUMENT RESUME

ED 156 920 CE 017 410

AUTHOR	Hendirx, Laborn J.; Patton, Bob
TITLE	Cement Mason's Curriculum. Instructional Units.
INSTITUTION	Associated General Contractors of America, Washington, D.C.; Oklahoma State Dept. of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.
PUB DATE	75
NOTE	1,124p.
AVAILABLE FROM	Associated General Contractors, 1957 E. Street N.W., Washington, D.C. 20006 (Teacher, $25.00; Student, $20.00)
EDRS PRICE	MF-$2.00 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	Audiovisual Aids; Blueprints; *Building Materials; *Cement Industry; Construction (Process); Criterion Referenced Tests; Curriculum Guides; Equipment; Equipment Maintenance; Job Application; *Job Skills; Learning Activities; Learning Modules; *Masonry; Objectives; Performance Based Education; Road Construction; Safety; *Trade and Industrial Education
IDENTIFIERS	*Cement Masonry

ABSTRACT

To assist cement mason instructors in providing comprehensive instruction to their students, this curriculum guide treats both the skills and information necessary for cement masons in commercial and industrial construction. Ten sections are included, as follow: related information, covering orientation, safety, the history of cement, and applying for a job; concrete materials; tools and equipment; placing concrete; concrete finishes for buildings; concrete finishes for highways; curing and protection; blueprint reading and estimating; surface treatment; and equipment repair. Each section is composed of one or more instructional units organized into eight parts: (1) student behavioral objectives, which state the goals of the course; (2) suggested activities outlining steps for both students and instructors to accomplish specific objectives; (3) information sheets, which provide the content necessary to meet the knowledge objectives of the unit; (4) transparency masters to reinforce the learning process; (5) job sheets, which outline the skills being taught; (6) assignment sheets for homework or classroom use (answer sheets are also included); (7) paper-pencil and performance tests constructed to measure student achievement of each objective; and (8) test answers. (ELG)

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CEMENT MASON'S CURRICULUM

Instructional Units

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William L. Pemberton, Chairman, Manpower and Training Committee

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1975

CE 017 410

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Edited by
State Department of Vocational and Technical Education
Stillwater, Oklahoma

Distributed by

Associated General Contractors of America
1957 E Street, N.W., Washington, D.C. 20006
and the
Curriculum and Instructional Materials Center, Oklahoma State
Department of Vo-Tech Education
Stillwater, Oklahoma 74074

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FOREWORD

In 1974, the Associated General Contractors of America met with representatives of the Oklahoma Curriculum and Instructional Materials Center to discuss the possibility of developing, as a cooperative project, a course of instruction that would be especially designed for training the cement mason who will make his career in industrial and commercial construction.

This publication is the result of those original discussions. It is the product of close coordination between general contractors, men who actually work in construction, and vocational-technical educators. It represents a conscious effort to mold the practical experience of personnel from the world of construction with the best instructional methods available from the world of education.

The trainers of construction craftsmen are faced with the challenge of providing thorough and modern training to the backbone of the construction industry, its work force. The purpose of this manual is to assist cement mason instructors in providing a uniformly high caliber of thorough instruction to their student craftsmen. This publication should be supplemented by each instructor's own methods and materials. The information in the manual may be adapted to coincide with local conditions that dictate modification in content or method.

Dr. Francis T. Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

William L. Pemberton, Chairman
Manpower and Training Committee
Associated General Contractors of
America

PREFACE

For many years contractors and those responsible for training cement masons have felt the need for instructional material to be used in training the cement mason. The Associated General Contractors of America with the cooperation and support of the Oklahoma State Department of Vocational-Technical Education, Curriculum Center, have accepted the challenge to produce a manual for use in training the cement mason in those areas in which he is expected to be proficient.

Instructional material in this manual is written in terms of student performance using measurable behavioral objectives. This is an innovative approach to teaching which accents and augments the teaching-learning process. Criterion referenced evaluation instruments provide for a uniform measurement of student progress.

Cement mason instructors are faced with the challenge of providing students with the skill and related information necessary to meet the demands of a changing profession. Competition for jobs is greater than ever. Therefore, the cement mason must be better trained and better equipped to find and retain meaningful employment.

The purpose of this manual is to assist cement mason instructors in providing instruction throughout the industry. This publication should be supplemented by each instructor's methods and materials. Any information in this manual that does not concur with the instructor's course of study can very easily be modified to meet his needs.

Laborn J. "Bud" Hendrix

Bob Patton

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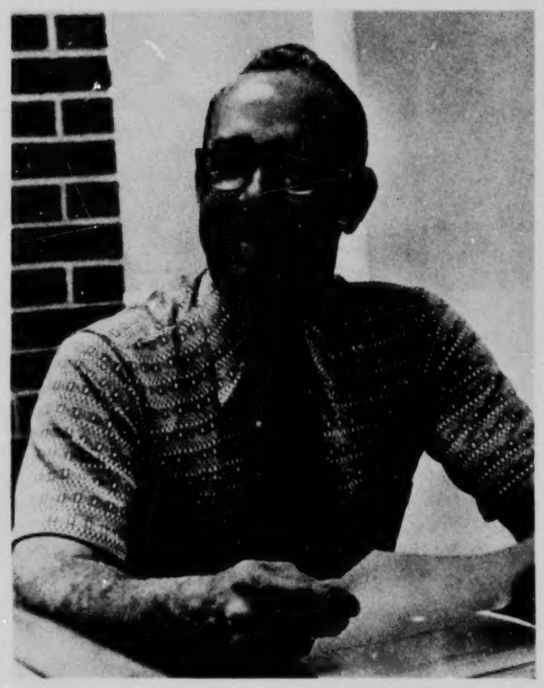

Bud Hendrix was born in 1923 in Indianapolis, Indiana. He started his training by working with his father, also a cement mason, during school vacations his junior and senior years of high school. Bud's formal education ended with the completion of high school.

In 1942 Bud joined the Cement Mason's International Association of the United States and Canada, Local Union #532, in Indianapolis, Indiana. Bud's term as a cement mason was short-lived when he had to take a leave of absence to join the armed forces in early 1943. He spent thirty-seven months in the Navy and then returned to Indianapolis and Local #532 to complete his three years apprenticeship. At that time, Bud was employed by A.V. Stackhouse Construction Company. He stayed with this firm until late 1948, when he went to work for Wilhelm Construction for whom he worked until he joined the George Bahre Company in the spring of 1949. He has remained with George Bahre for the past twenty-six years. Bud is presently classified as concrete superintendent, a position he earned after working at the trade for many years. He is still a member in good standing of the Cement Mason's Local #532 in Indianapolis. He has held several positions as an officer in the Local over the past years and has instructed journeymen and apprentices in two upgrading classes. For the development of this cement mason's manual, his thirty-three years of experience were loaned to the Associated General Contractors of America. During this period, he served as a member of the staff of the Oklahoma State Department of Vocational and Technical Education Curriculum and Instructional Materials Center.

ACKNOWLEDGEMENTS

Appreciation is expressed to the many individuals and companies who gave their time and knowledge in the preparation of this manual.

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We are grateful to the following individuals and companies for their technical support during development of this curriculum.

Clarence and Dave Lambert, Lambert Construction Company, Stillwater, Oklahoma

Al McGuire, Nelson and Sloan Transit Mixed Concrete Company, Chula Vista, California

Mashkoor Alam, Dolese Ready Mix Concrete Company, Oklahoma City, Oklahoma

George Bahre and Paul Ramsey, George Bahre Company, Indianapolis, Indiana

John St. Aubin, Regional Director, Portland Cement Association, OPCMIA, Manpower Development and Training Program, Skokie, Illinois

Tom Grant, Irving Materials Inc., Greenfield, Indiana

Bill Skieth, Oklahoma City, Oklahoma

Darrel Mecklenburg, Mecklenburg and Associates, Inc., Stillwater, Oklahoma

Mangum Building Company, General Contractors, Oklahoma City, Oklahoma

Robertson Sillars, Communication Material Department, Portland Cement Association, Skokie, Illinois

Lanny J. David, Marketing Services Photographer, CMI Corporation, Oklahoma City, Oklahoma

K. J. Petraskas, Oklahoma State Highway Department, Oklahoma City, Oklahoma

Ivan Armstrong, Curriculum Specialist, State Department of Vocational and Technical Education, Stillwater, Oklahoma

Gratitude is expressed to Sarah Mussett for editing, to Nancy Skach and Debbie Burchette for assistance with research, and to Cindy Johnson and the Communications Center for typing.

Special appreciation goes to Ron Meek, Coordinator; Irene Clements, Assistant Coordinator; Bob Rea, Media Graphics Designer; Dean Clark and Mike Adair, Illustrators. To the secretaries we also say thanks: Mary Kay Jennings, Barbara Reed, Sandra Lewis, Linda Lenington, Nancy Evans, Suzanne Hiney, and Kendell Wynn.

Our sincere thanks to:

Mr. Arthur Prado and other personnel of the Western Pennsylvania Heavy and Highway Construction Industry Advancement Program of Pittsburg, Pennsylvania, for their assistance in developing the highway unit.

Mr. Joseph T. Power, General President of the Operative Plasterer's and Cement Mason's International Association of the United States and Canada for his encouragement of this project. The cooperation of members of the OPCMIA has given this curriculum special expertise and the practical approach of craftsmen who are thoroughly experienced in the practice of their trade.

USE OF THIS PUBLICATION

Instructional Units

The cement mason's curriculum includes ten sections. Each section consists of one or more units of instruction. Each instructional unit includes behavioral objectives, suggested activities for instructors and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to tests. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the instructor will help him determine:

A. The amount of material that can be covered in each class period.
B. The skills which must be demonstrated.
    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations
C. Supplementary materials such as pamphlets and filmstrips that must be ordered.
D. Resource people who must be contacted.

Objectives

Each unit of instruction is based on behavioral objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Behavioral objectives are stated in two forms: terminal objectives, stating the subject matter to be covered in a unit of instruction and specific objectives, stating the student performance necessary to reach the terminal objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the instructor and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which were used in this material:

Name
Label
List in writing
List orally
Letter
Record
Repeat
Give

Identify
Select
Mark
Point out
Pick out
Choose
Locate

Describe
Define
Discuss in writing
Discuss orally
Interpret
Tell how
Tell what
Explain

Order
Arrange
Sequence
List in order
Classify
Divide
Isolate
Sort

Distinguish
Discriminate

Construct
Draw
Make
Build
Design
Formulate
Reproduce
Transcribe
Reduce
Increase
Figure

Demonstrate
Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn off/on
(Dis) assemble
(Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit

Instructors should feel free to add objectives which will fit the material to the needs of his students and community. When an instructor adds objectives, he should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. The activities are listed according to whether they are the responsibility of the instructor or the student.

Instructor: Duties of the instructor will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss terminal and specific objectives and information sheet; give test. Instructors are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Students: Student activities are listed which will help the student to achieve the objectives for the unit.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives of the unit. The instructor will find that information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the terminal objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the instructor to speak too loudly.)

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and instructor to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances he might reasonably expect from a person who has had this training.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or instructor for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the instructor spot difficulties being encountered by students in their efforts to accomplish the terminal objective. Test items for objectives added by the instructor should be constructed and added to the test. Progress sheets are provided for student and instructor to record acceptable performance of skills outlined in job sheets.

Test Answers

Test answers are provided for each unit. These may be used by the instructor and/or student for checking student achievement of the objectives.

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(NOTE: This is an alphabetized list of the publications used in completing this manual.)

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ORIENTATION
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list places of employment and facts concerning the occupational outlook for a cement mason. He should be able to list student requirements and steps involved in commercial construction. He should be able to complete a personal information sheet. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. List two facts concerning the occupational outlook for the cement mason.
2. Name five employment opportunities for cement masons.
3. List six student requirements for the cement mason's program.
4. Name seven major subskills involved in the cement mason's trade.
5. Demonstrate the ability to complete a personal information sheet.

ORIENTATION
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information and assignment sheets.

   C. Discuss terminal and specific objectives.

   D. Discuss information and assignment sheets.

   E. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheet.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Assignment Sheet #1--Personal Information Sheet

   D. Test

   E. Answers to test

II. References:

   A. *Occupational Outlook Handbook,* 1970-71 edition. U.S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 1650.

   B. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

ORIENTATION
UNIT I

INFORMATION SHEET

I. Occupational outlook

   A. Job opportunities result each year from the need to replace experienced cement masons who retire or die

   B. The number of new construction jobs being done each year requires more cement masons

II. Employment opportunities

   A. Independent and union affiliated residential building contractors

   B. Independent and union affiliated commercial contractors

   C. Repair work on older buildings

   D. Precast plants

   E. Ready-mix concrete plants

III. Student requirements for the cement mason's program

   A. Operate all power tools correctly

   B. Be safety conscious and follow safety regulations

   C. Take instructions readily and follow directions

   D. Be a good citizen

   E. Control temper at all times

   F. Display enthusiasm about work

   G. Exhibit pride in the cement mason's trade

   H. Practice conservation of materials and man-hours

   I. Be punctual

IV. Major subskills involved in the cement mason's trade

   A. Blueprint reading

   B. Measuring

INFORMATION SHEET

C. Use of hand tools

D. Use of power tools

E. Making material estimates

F. Placing, compacting, and rodding concrete

G. Concrete finishing

H. Rubbing and patching

I. Knowledge of material characteristics

ORIENTATION
UNIT I

ASSIGNMENT SHEET #1--PERSONAL INFORMATION SHEET

NAME______________________ CLASS__________

HOME ADDRESS______________________

HOME PHONE______________________

PARENTS' NAMES (or guardians)______________________

PARENTS' OCCUPATIONS______________________

PARENTS' BUSINESS PHONES______________________

WHERE CAN YOUR PARENTS BE REACHED IN CASE OF AN EMERGENCY? __________

____

FAMILY DOCTOR ______________________

LIST SHOP COURSES YOU HAVE HAD ______________________

____

SKILL EXPERIENCE ______________________

____

NAME OF INSURANCE COMPANY ______________________

____

ORIENTATION
UNIT I

TEST

1. List two facts concerning the occupational outlook for the cement mason.

   a.

   b.

2. Name five employment opportunities for cement masons.

   a.

   b.

   c.

   d.

   e.

3. List six student requirements for the cement mason's program.

   a.

   b.

   c.

   d.

   e.

   f.

4. Name seven major subskills involved in the cement mason's trade.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

5. Demonstrate the ability to complete a personal information sheet.

   (NOTE: If this activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

ORIENTATION
UNIT I

ANSWERS TO TEST

1. a. Job opportunities result each year from the need to replace experienced cement masons who retire or die

   b. The number of new construction jobs being done each year requires more cement masons

2. a. Independent and union affiliated residential building contractors

   b. Independent and union affiliated commercial contractors

   c. Repair work on older buildings

   d. Precast plants

   e. Ready-mix concrete plants

3. Any six of the following are acceptable.

   a. Operate all power tools correctly

   b. Be safety conscious and follow safety regulations

   c. Take instructions readily and follow directions

   d. Be a good citizen

   e. Control temper at all times

   f. Display enthusiasm about work

   g. Exhibit pride in the cement masonry trade

   h. Practice conservation of materials and man-hours

   i. Be punctual

4. Any seven of the following are acceptable.

   a. Blueprint

   b. Measuring

   c. Use of hand tools

   d. Use of power tools

  - e. Making material estimates
  - f. Placing, compacting, and rodding concrete
  - g. Concrete finishing
  - h. Rubbing and patching
  - i. Knowledge of material characteristics

5. Performance skills evaluated to the satisfaction of the instructor.

SAFETY
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list rules for personal and general safety. He should be able to select the correct fire extinguisher for the classes of fire and match the colors of the safety color code to their applications. The student should be willing to sign the safety pledge form. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define the terms safety, accident, and first aid.
2. Match the six colors of the safety color code to their applications.
3. List five rules for personal safety.
4. List eight rules for general safety.
5. List five methods used to maintain a clean and orderly work area.
6. Match the three classes of fire to statements defining each class.
7. List the three components of the fire triangle.
8. Match the type of fire extinguisher to the class of fire for which each is used.
9. Indicate a willingness to work safely by subscribing to the safety pledge form.

SAFETY
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet and safety pledge form.

   (NOTE: It is recommended that the student be taught the ten or thirty hour construction safety and health training course.)

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete the safety pledge form.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters:

      1. TM 1--The Fire Triangle

      2. TM 2--Types of Fire Extinguishers

   D. Assignment Sheet #1--Safety Pledge Form

   E. Test

   F. Answers to test

II. References:

A. Kidde Portable Extinguishers. *The ABC's of Fire Protection.* Belleville, New Jersey: Walter Kidde and Company, Inc.

B. U.S. Department of Health, Education, and Welfare, Office of Education. *An Accident Prevention Program for School Shops and Laboratories.* Department of Vocational Education, Pennsylvania State University, 1967.

C. Department of Labor. *Federal Register.* Vol. 36. Number 105. Part II. May 29, 1971.

D. Department of Education, Division of Vocational Education, State of New Jersey. *Safety Practices and Procedures in School Shops.* Trenton: New Jersey State Department of Vocational Education.

E. *Manual of Accident Prevention in Construction.* The Associated General Contractors of America, 1971.

F. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

SAFETY
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Safety--State or condition of being safe; freedom from danger, risk, or injury
- B. Accident--Includes any suddenly occurring, unintentional event which causes injury or property damage
- C. First aid--Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained

II. Colors and applications of the safety color code

- A. Federal safety red--Basic color for the identification of:
  1. Fire protection equipment and apparatus
  2. Portable containers of flammable liquids
  3. Emergency stop bars, stop buttons, and emergency electrical stop switches on machinery
- B. Federal safety yellow--Basic color for designating:
  1. Caution and for marking physical hazards
  2. Waste containers for explosive or combustible materials
  3. Caution against starting, using, or moving equipment under repair
  4. Identification of the starting point or power source of machinery
- C. Federal safety orange--Basic color for designating:
  1. Dangerous parts of machines
  2. Safety starter buttons
  3. Exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws
- D. Federal safety purple--Basic color for designating radiation hazards
- E. Federal safety green--Basic color for designating:
  1. Safety

INFORMATION SHEET

2. Location of first aid equipment

   (NOTE: This applies to equipment other than fire fighting equipment.)

F. Federal safety black and white--(used individually or in combination) Basic colors for designating:

   1. Traffic flow

   2. Housekeeping purposes

III. Personal safety rules

   A. Wear clothing appropriate to the instructional activity being performed

   B. Confine long hair before operating rotating equipment

   C. Always wear safety glasses; use suitable helmets and goggles for cutting, chipping, and grinding

   D. Remove ties when working around machine tools or rotating equipment

   E. Remove rings and other jewelry when working

   F. Conduct yourself in a manner conducive to safe practices

   G. Use soap and water frequently as a method of preventing skin diseases

IV. General safety rules

   A. Keep all hand tools sharp, clean, and in safe working order

   B. Report any defective tools, machines, or other equipment to the supervisor

      (NOTE: In this unit, the term supervisor refers to the foreman, superintendent, or instructor who is in charge of the work area.)

   C. Retain all guards and safety devices except with the specific authorization of the supervisor

   D. Operate a hazardous machine only after receiving instruction on how to operate the machine safely

   E. Report all accidents to the supervisor regardless of nature or severity

   F. Have operator turn off power and make certain the machine has stopped running before leaving

INFORMATION SHEET

- G. Make sure all guards and barriers are in place and adjusted properly before starting a machine tool
- H. Disconnect the power from machine tools before performing the maintenance task of oiling or cleaning
- I. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
- J. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held
- K. Keep the work area floor clear of scraps and litter
- L. Clean up any spilled liquids immediately
- M. Store oily rags or oily waste in metal containers
- N. Clean the chips from a machine with a brush, not with a rag or bare hands
- O. Do not use compressed air to clean your person or clothing
- P. Use only approved scaffolding

V. Methods used to maintain a clean and orderly work area

- A. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning
- B. Stack materials and supplies safely or store in proper place
- C. Store tools and accessories safely in cabinets, on racks, or in other suitable devices
- D. Clear working areas and work benches of debris and other hazards
- E. Clean and free floors from obstructions and slippery substances
- F. Free aisles, traffic areas, and exits of materials and other debris
- G. Dispose of combustible materials properly or store in approved containers
- H. Store oily rags in self-closing or spring-lid metal containers
- I. Know the proper procedures to follow in keeping the work area clean and orderly
- J. Keep sufficient brooms, brushes, and other housekeeping equipment readily available

INFORMATION SHEET

VI. Classes of fire

A. Class A--Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish

B. Class B--Fires that occur with flammable liquids, such as gasoline, oil, grease, paints, and thinners

C. Class C--Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring

VII. Three components of the fire triangle (Transparency 1)

A. Fuel--Any combustible material

B. Heat--Enough to raise the fuel to its ignition temperature

C. Oxygen--Necessary to sustain combustion

(NOTE: To produce fire these three elements are necessary and must be present at the same time. If any one of the three is missing, a fire cannot be started. With the removal of any of them, the fire will be extinguished.)

VIII. Types of fire extinguishers (Transparency 2)

A. Pressurized water--Used on Class A fires; operates usually by squeezing a handle or trigger

B. Soda acid--Used on Class A fires; operates by turning extinguisher upside down

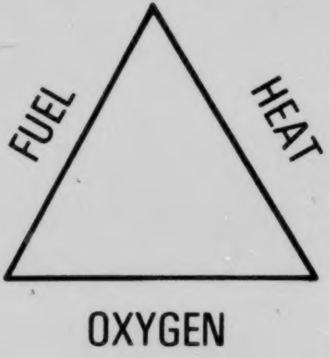
C. Carbon dioxide (CO_2)--Used on Class B and C fires; operates usually by squeezing handle or trigger

D. Dry chemical--Used on Class B and C fires; operates usually by squeezing a handle, trigger, or lever

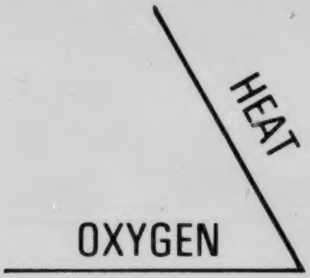
E. Foam--Used on Class A and B fires; operates by turning extinguisher upside down

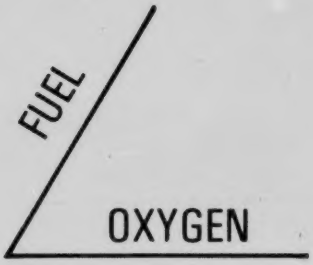
The Fire Triangle

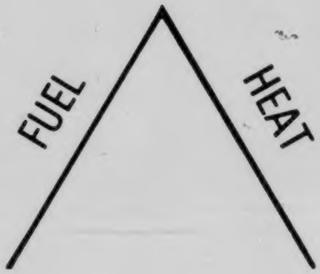
To produce fire, three things must be present at the same time.


FUEL
HEAT
OXYGEN

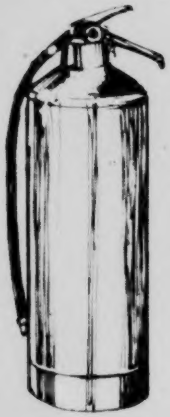
If any one of the three is missing, a fire cannot be started or, with the removal of any one, the fire will be extinguished.


HEAT
OXYGEN

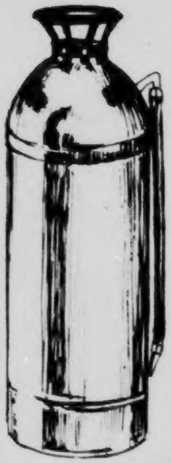

FUEL
OXYGEN



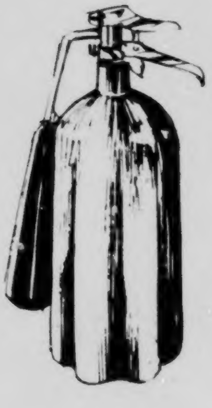
Types of Fire Extinguishers



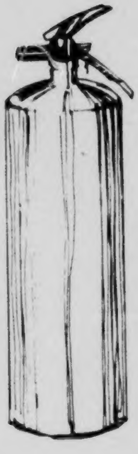
Pressurized Water



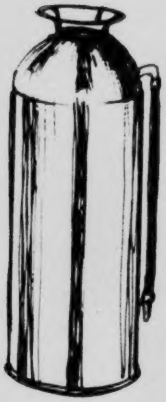
Soda-Acid



Carbon Dioxide



Dry Chemical



Foam

SAFETY
UNIT II

ASSIGNMENT SHEET #1--SAFETY PLEDGE FORM

________________________________, who is enrolled in Vocational __________

________________, will, as a part of his shop experience, operate machines, providing that his parent or guardian gives written permission.

It is understood that each student will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it himself. The student must assume responsibility for following safe practices, and we, therefore, ask that he subscribe to the following safety pledge.

1. I promise to follow all safety rules for the shop.
2. I promise never to use a machine without first having permission from the instructor.
3. I will not ask permission to use a particular machine unless I have been instructed in its use and have made 100% on the safety test for that machine.
4. I will report any accident or injury to the teacher immediately.

Date__________ Student's signature________________________________

I hereby give my consent to allow my son to operate all machines and equipment necessary in carrying out the requirements of the course in which he is enrolled.

Date__________ Parent's signature________________________________

Parents are cordially invited to visit the shop to inspect the machines and to see them in operation.

SAFETY
UNIT II

TEST

1. Define the following terms.

   a. Safety--

   b. Accident--

   c. First aid--

2. Match the following colors of the safety color code to their correct applications. A blank may have more than one answer.

   ______a. Designates caution

   ______b. Used to identify the location of fire protection equipment

   ______c. Designates the location of safety and first aid equipment

   ______d. Designates dangerous parts of equipment

   ______e. Designates traffic flow

   ______f. Designates radiation hazards

   1. Green
   2. White
   3. Orange
   4. Purple
   5. Black
   6. Red
   7. Yellow

3. List five personal safety rules.

   a.

   b.

   c.

   d.

   e.

4. List eight rules for general safety.

   a.

   b.

   c.

   d.

e.

f.

g.

h.

5. List five methods used to maintain a clean and orderly work area.

a.

b.

c.

d.

e.

6. Match the classes of fire to the correct statements defining each class.

______a. Fires that occur with flammable liquids, such as gasoline, oil, or grease

______b. Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish

______c. Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring

1. Class A
2. Class B
3. Class C

7. List the three components of the fire triangle.

a.

b.

c.

8. Match the type of fire extinguisher on the right to the class of fire for which each is used. A blank may have more than one answer.

   ______a. Fires that occur with flammable liquids, such as gasoline, oil, or grease

   ______b. Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring

   ______c. Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish

   1. Pressurized water
   2. Carbon dioxide (CO_2)
   3. Dry chemical
   4. Soda acid
   5. Foam

9. Indicate a willingness to work safely by subscribing to the safety pledge form.

   (NOTE: If this activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

SAFETY
UNIT II

ANSWERS TO TEST

1. a. State or condition of being safe; freedom from danger, risk, or injury

   b. Includes any suddenly occuring, unintentional event which causes injury or property damage

   c. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

2. a. 7

   b. 6

   c. 1

   d. 3

   e. 2 and 5

   f. 4

3. Any five of the following are acceptable.

   a. Wear clothing appropriate to the instructional activity being performed

   b. Confine long hair before operating rotating equipment

   c. Always wear safety glasses; use suitable helmets and goggles for cutting, chipping, and grinding

   d. Remove ties when working around machine tools or rotating equipment

   e. Remove rings and other jewelry when working

   f. Conduct yourself in a manner conducive to safe practices

   g. Use soap and water frequently as a method of preventing skin diseases

4. Any eight of the following are acceptable.

   a. Keep all hand tools sharp, clean, and in safe working order

   b. Report any defective tools, machines, or other equipment to the supervisor

   c. Retain all guards and safety devices except with the specific authorization of the supervisor

- d. Operate a hazardous machine only after receiving instruction on how to operate the machine safely
- e. Report all accidents to the supervisor regardless of nature or severity
- f. Have operator turn off power and make certain the machine has stopped running before leaving
- g. Make sure all guards and barriers are in place and adjusted properly before starting a machine tool
- h. Disconnect the power from machine tools before performing the maintenance task of oiling or cleaning
- i. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
- j. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held
- k. Keep the work area clear of scraps and litter
- l. Clean up any spilled liquids immediately
- m. Store oily rags or oily waste in metal containers
- n. Clean the chips from a machine with a brush, not with a rag or bare hands
- o. Do not use compressed air to clean your person or clothing
- p. Use only approved scaffolding

5. Any five of the following are acceptable.

- a. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning
- b. Stack materials and supplies safely or store in proper place
- c. Store tools and accessories safely in cabinets, on racks, or in other suitable devices
- d. Clear working areas and work benches of debris and other hazards
- e. Clean and free floors from obstructions and slippery substances
- f. Free aisles, traffic areas, and exits of materials and other debris
- g. Dispose of combustible materials properly or store in approved containers
- h. Store oily rags in self-closing or spring-lid metal containers

i. Know the proper procedures to follow in keeping the area clean and orderly

j. Keep sufficient brooms, brushes, and other housekeeping equipment readily available

6. a. 2

   b. 1

   c. 3

7. a. Fuel

   b. Heat

   c. Oxygen

8. a. 2, 3, and 5

   b. 2 and 3

   c. 1, 4, and 5

9. Satisfied by Assignment Sheet #1--Evaluated to the satisfaction of the instructor

HISTORY OF CEMENT
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the trainee should be able to distinguish between cement and concrete and brand name and type. He should be able to discuss the historical events pertaining to the early years of the cement industry. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the trainee should be able to:

1. Match terms associated with the history of cement to the correct definitions.
2. Discuss briefly the history of cement, giving names, dates, and places.
3. Match types of kilns used in cement production to their capacities.
4. Select from a list the size seive that cement will pass through.
5. List the basic raw materials used in cement.
6. Select from a list the word that properly identifies portland cement.
7. Match types of cement to their uses.
8. Discuss in a short paragraph three things a cement mason should know about a bag of cement.
9. Distinguish between cement and concrete.

HISTORY OF CEMENT
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each trainee with objective sheet.

   B. Provide each trainee with information sheet.

   C. Discuss terminal and specific objectives.

   D. Discuss information sheets.

   E. Write to Portland Cement Association for film, "From Mountains to Microns," and for "Quality Concrete Slide Reference File." Show both in class.

   F. Write to Portland Cement Association for copies of booklets, "The Making of Portland Cement" and "Cement Mason's Manual for Residential Construction." Pass the booklets out in class.

   G. Show samples of cement.

   H. Give test.

II. Trainee:

   A. Read objective sheet.

   B. Study information sheets.

   C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheets

   C. Transparency masters

      1. TM 1--Joseph Aspdin's Patent

      2. TM 2--Coplay, Pennsylvania: First Cement Plant in United States

3. TM 3--Modern Cement Plant
4. TM 4--Allen House: Oldest Concrete Structure in United States
5. TM 5--Basic Raw Materials for Making Portland Cement
6. TM 6--Bag of Cement

D. Test

E. Answers to test

II. References:

A. *The Making of Portland Cement.* Skokie, Illinois: Portland Cement Association, 1964.

B. *Concrete Technology.* Skokie, Illinois: Portland Cement Association, 1965.

C. Portland Cement Association. "Quality Concrete Slide Reference File." Old Orchard Road, Skokie, Illinois 60076.

HISTORY OF CEMENT
UNIT II

INFORMATION SHEET

I. Terms and definitions

   A. Portland cement--Finely ground material consisting primarily of the raw materials lime, silica, alumina, iron ore, and gypsum

   B. Hydraulic cement--Cement capable of setting and hardening underwater due to interaction of water and the constituents of cement

   C. Natural cement rock--Natural rock that contains many of the essential chemicals in almost the desired proportions

   D. Portland Cement Association (P.C.A.)--Organization to improve and extend the uses of portland cement and concrete

   E. Sieve--Metallic netting used to separate material according to size

   F. Lime--Calcium oxide taken from limestone, shells, and other forms of calcium carbonate

   G. Silica--Silicon dioxide used in making cement

   H. Alumina--Material containing aluminum oxide, blended into cement

   I. Iron ore--Metallic mineral; one of the basic raw materials used in making cement

   J. Gypsum--Mined mineral used in cement to control set and added to cement in the final process

II. Historical events in the production of cement

   A. Word "cement" is more than 2,000 years old

   B. Hydraulic cement was produced in Holland in 1200 A.D.

   C. In 1756 John Smeaton constructed the Eddystone lighthouse in England (probably first concrete structure built with portland cement)

   D. Diversion dam built in San Diego, California, about 1769 (probably first concrete structure built in America)

   E. Portland cement was patented in 1824 by Joseph Aspdin (Transparency 1)

INFORMATION SHEET

F. Portland cement was so named because it resembled a stone on the Isle of Portland, England

G. First shipment of portland cement to United States from Europe was in 1868

H. Natural cement rock was found in large quantities in districts of Rosendale, New York; Lehigh Valley, Pennsylvania; and Louisville, Kentucky

I. In Coplay, Pennsylvania, the site of the first cement plant in the U.S., David O. Saylor started experimenting and the results were so great that he came up with a portland cement that he patented in 1871. This date is regarded as beginning of portland cement in America. In 1876 Saylor's cement won an award at the Centennial Exposition in Pennsylvania (Transparencies 2 and 3)

J. One of the most emminent personalities in America was Robert W. Lesley, a cement manufacturer who became the first president of P.C.A. (formed in 1916)--also wrote the book "History of the Portland Cement Industry in the United States"

K. One of the oldest concrete structures in United States is the Allen House in Honesdale, Pennsylvania, built in 1857 and still standing (Transparency 4)

L. In 1974, there are 50 cement companies that operate 170 plants with a total yearly capacity of 80-85 million tons of portland cement

III. Types of kilns used in the production of cement and their capacities

A. Bottle kiln--15 to 30 barrels per day

B. Shaft kiln--40 to 60 barrels per day

C. Early rotary kiln--120 to 180 barrels per day

D. Modern kiln--10,000 barrels per day

IV. Cement is ground so fine that it will pass through a no. 200 sieve that has 40,000 openings per square inch

(NOTE: Cement is ground so fine that it will pass through a seive that holds water.)

V. Basic raw materials used in cement (Transparency 5)

A. Lime

B. Silica

INFORMATION SHEET

C. Alumina

D. Iron ore

E. Gypsum

VI. Portland cement--Type of cement and not a brand name

VII. Most common types of portland cement and how they are used

A. Type I--Normal portland cement, general purpose

B. Type II--Modified portland cement for moderate sulfate resistance, lower heat of hydration, generally used for massive construction

C. Type III--High-early-strength portland cement, used when high strength at an early age is desired

D. Type IV--Low heat portland cement, used where rate of heat must be kept at a minimum, intended only in massive construction

E. Type V--Sulfate resistant portland cement, used only in construction that is exposed to severe sulfate action

F. White portland cement--Pure white color, generally used for architectural purposes

(NOTE: There are several other types of cement used for special jobs.)

VIII. Bag of cement (Transparency 6)

A. Packaged in paper bags

B. Weighs 94 pounds

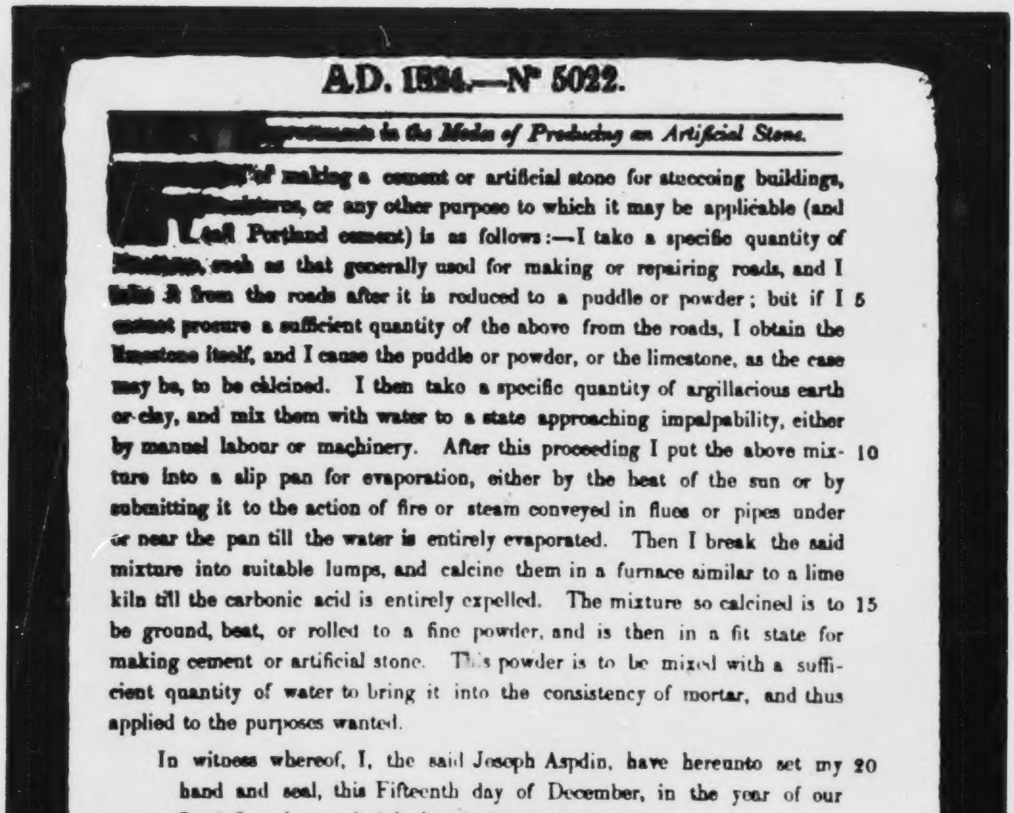
C. Volume--1 cubic foot

IX. Cement versus concrete

A. Cement is a manufactured product that goes into the making of concrete

B. Concrete is a material made from cement, sand, gravel, and water

Joseph Aspdin's Patent



A.D. 1824.—Nº 5022.

[illegible] Improvements in the Modes of Producing an Artificial Stone.

[illegible] of making a cement or artificial stone for stuccoing buildings, [illegible] cisterns, or any other purpose to which it may be applicable (and [illegible] call Portland cement) is as follows:—I take a specific quantity of limestone, such as that generally used for making or repairing roads, and I take it from the roads after it is reduced to a puddle or powder; but if I cannot procure a sufficient quantity of the above from the roads, I obtain the limestone itself, and I cause the puddle or powder, or the limestone, as the case may be, to be calcined. I then take a specific quantity of argillacious earth or clay, and mix them with water to a state approaching impalpability, either by manual labour or machinery. After this proceeding I put the above mixture into a slip pan for evaporation, either by the heat of the sun or by submitting it to the action of fire or steam conveyed in flues or pipes under or near the pan till the water is entirely evaporated. Then I break the said mixture into suitable lumps, and calcine them in a furnace similar to a lime kiln till the carbonic acid is entirely expelled. The mixture so calcined is to be ground, beat, or rolled to a fine powder, and is then in a fit state for making cement or artificial stone. This powder is to be mixed with a sufficient quantity of water to bring it into the consistency of mortar, and thus applied to the purposes wanted.

In witness whereof, I, the said Joseph Aspdin, have hereunto set my hand and seal, this Fifteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

JOSEPH (L.S.) ASPDIN.

AND BE IT REMEMBERED, that on the Fifteenth day of December, in the year of our Lord 1824, the aforesaid Joseph Aspdin came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Dunning, Esq.

Inrolled the Eighteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

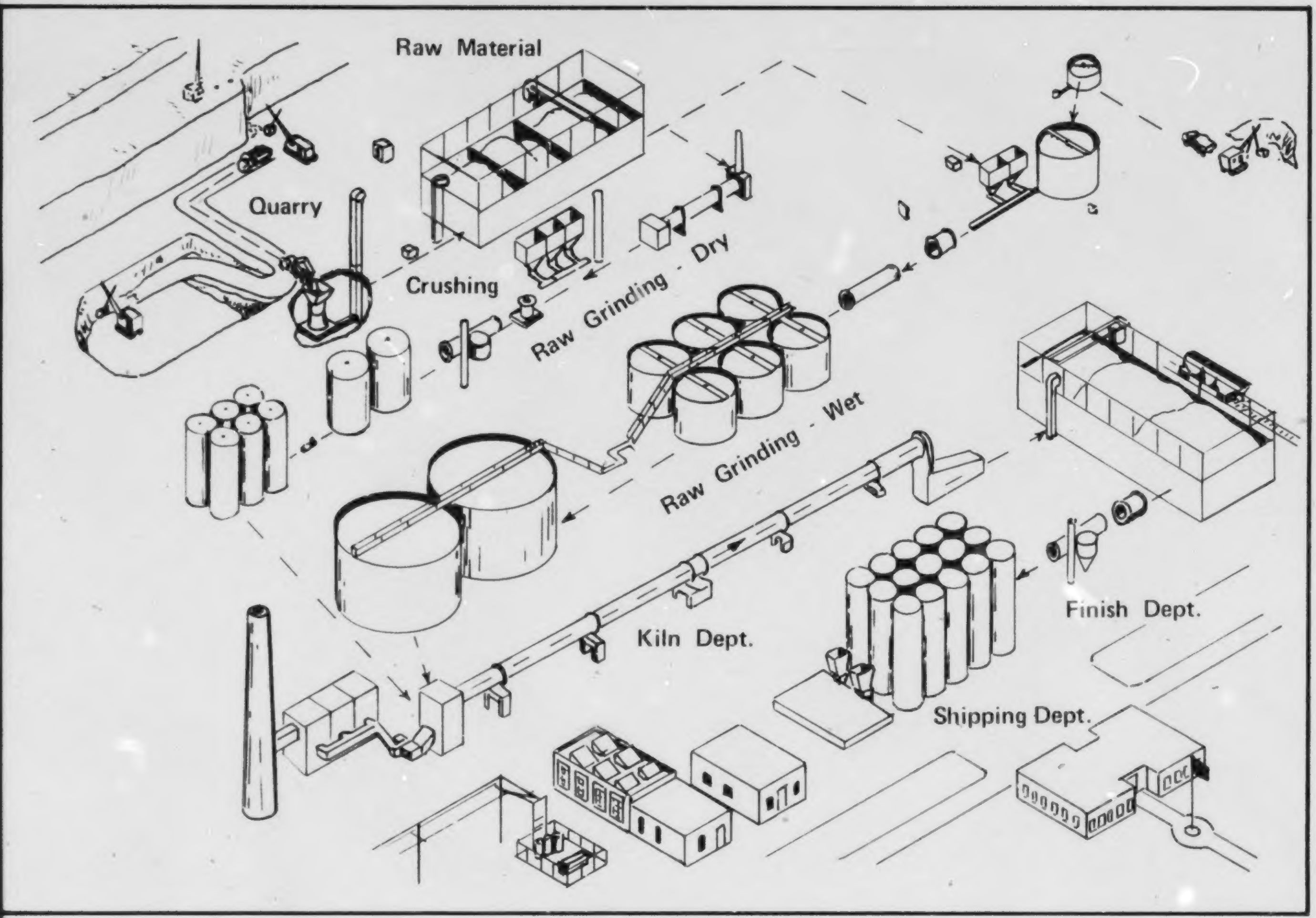
LONDON:
Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1857.

Photo courtesy of Portland Cement Association

Coplay, Pennsylvania: First Cement Plant in United States

Photo courtesy of Portland Cement Association

Modern Cement Plant


Raw Material
Quarry
Crushing
Raw Grinding - Dry
Raw Grinding - Wet
Kiln Dept.
Finish Dept.
Shipping Dept.

Allen House:
Oldest Concrete Structure in United States

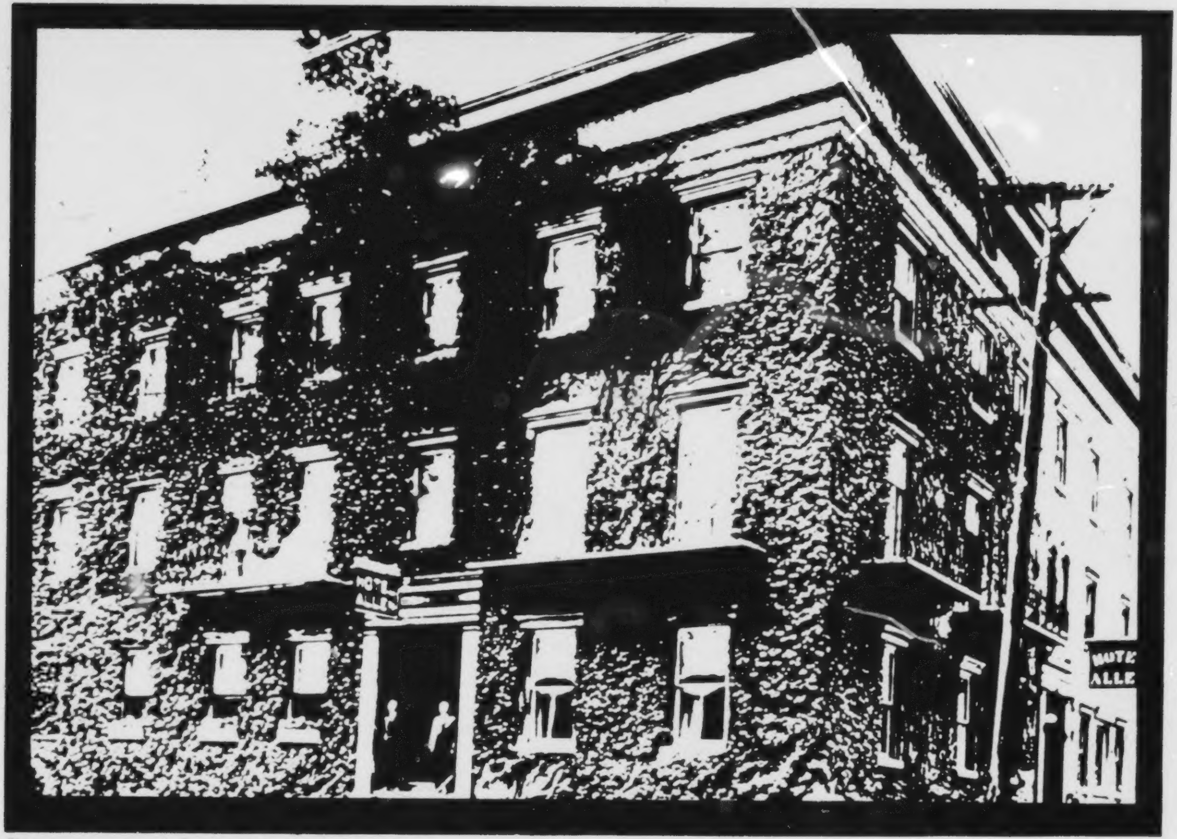
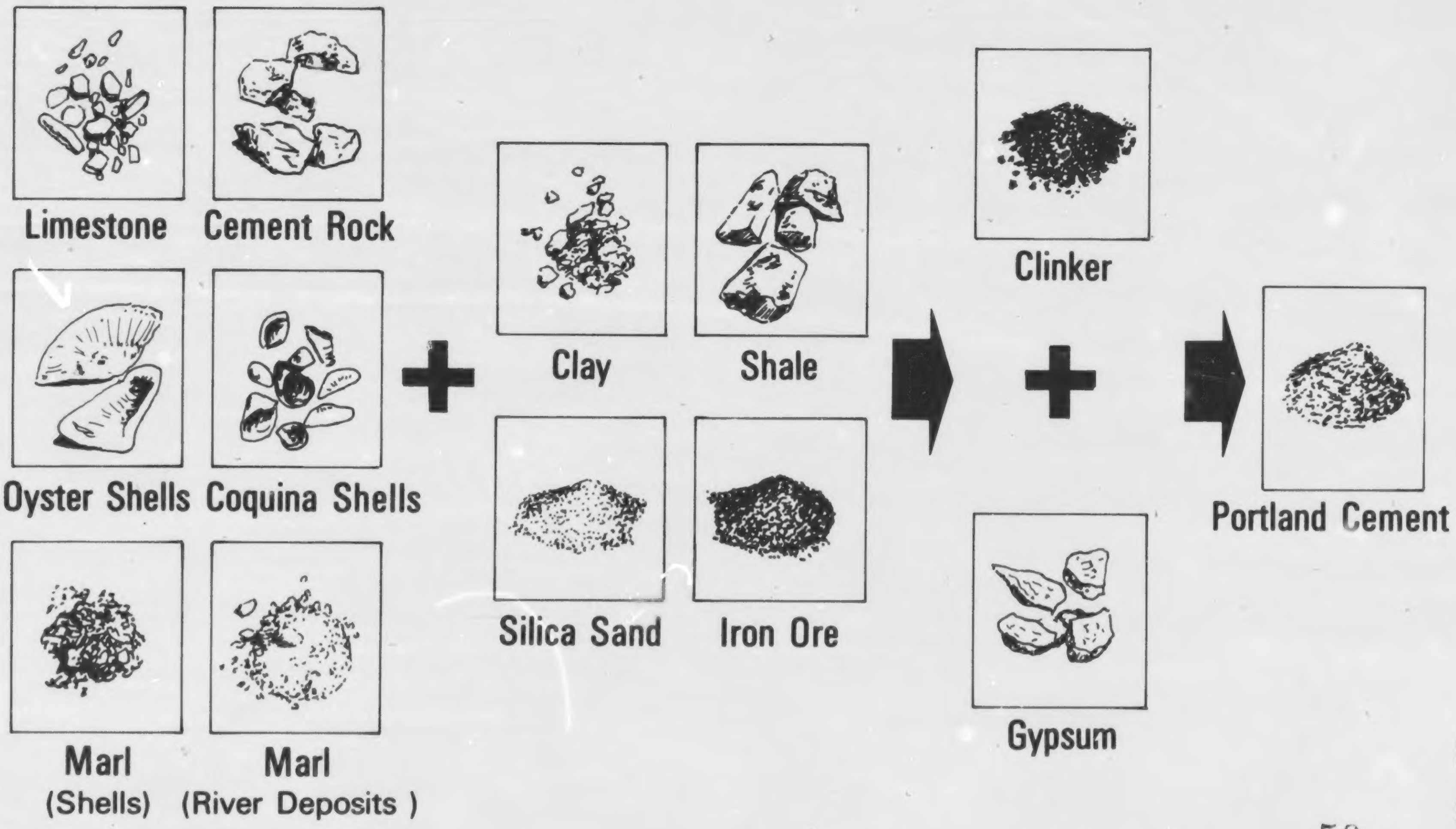


Photo courtesy of Portland Cement Association

Basic Raw Materials
For Making Portland Cement



Limestone

Cement Rock

Oyster Shells

Coquina Shells

Marl
(Shells)

Marl
(River Deposits)

+

Clay

Shale

Silica Sand

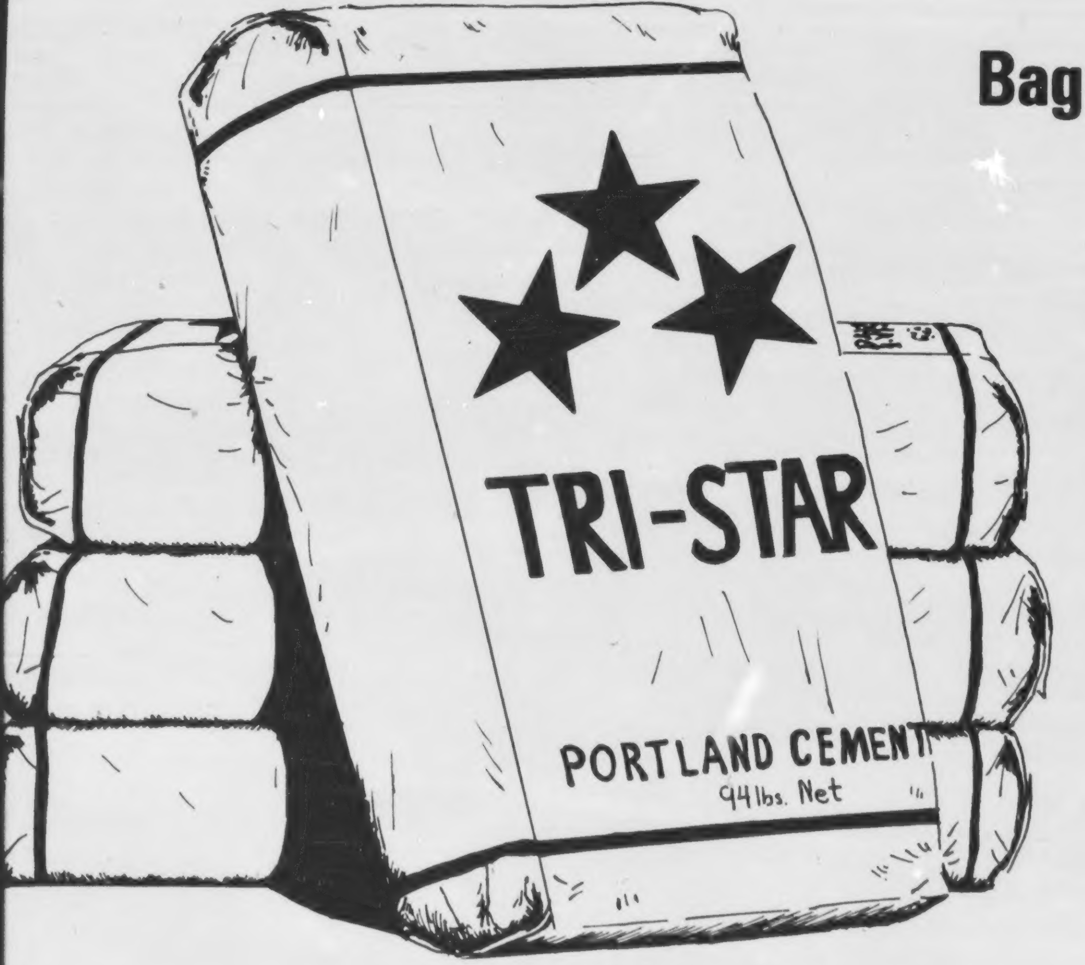
Iron Ore

Clinker

+

Gypsum

Portland Cement


TRI-STAR
PORTLAND CEMENT
94 lbs. Net

Bag of Cement

HISTORY OF CEMENT
UNIT II

TEST

1. Match terms on the right to the correct definitions.

______a. Mined mineral used in cement to control set and added to cement in the final process

______b. Silicon dioxide used in making cement

______c. Metallic netting used to separate material according to size

______d. Natural rock that contains many of the essential chemicals in almost the desired proportions

______e. Finely ground material consisting primarily of the raw materials lime, silica, alumina, iron ore, and gypsum

______f. Material containing aluminum oxide, blended into cement

______g. Calcium oxide taken from limestone, shells, and other forms of calcium carbonate

______h. Organization to improve and extend the uses of portland cement and concrete

______i. Cement capable of setting and hardening underwater due to interaction of water and constituents of cement

______j. Metallic mineral; one of the basic raw materials used in making cement

1. Portland cement
2. Portland Cement Association (P.C.A.)
3. Silica
4. Hydraulic cement
5. Sieve
6. Gypsum
7. Natural cement rock
8. Lime
9. Alumina
10. Iron ore

2. Discuss briefly the history of cement, giving names, dates, and places.

3. Match the type of kiln on the right to its capacity by placing the appropriate number in blank.

______a.	10,000 barrels per day	1.	Bottle kiln
______b.	120 to 180 barrels per day	2.	Shaft kiln
______c.	15 to 30 barrels per day	3.	Modern kiln
______d.	40 to 60 barrels per day	4.	Early rotary kiln

4. Select from the list the size seive that cement will pass through. Circle the correct letter.

   a. 4,000

   b. 2,000

   c. 60,000

   d. 40,000

5. List three basic raw materials used in cement.

   a.

   b.

   c.

6. Select from the list below the word that properly identifies portland cement. Circle your response.

   a. Manufacturer

   b. Type

   c. Brand name

7. Match the type of cement on the right to its proper use by placing the appropriate number in the blank.

______a.	Normal portland cement, general purpose	1.	White portland cement
______b.	Pure white, architectural purposes	2.	Type I
		3.	Type III
______c.	Low heat portland cement, used where rate of heat is kept at minimum, massive construction	4.	Type II
		5.	Type IV
______d.	High-early-strength, used when high strength at an early age is desired	6.	Type V

______e. Modified portland cement for moderate sulfate resistance, lower heat of hydration, generally used for massive construction

______f. Sulfate resistant portland cement, used only in construction that is exposed to severe sulfate action

8. Discuss in a short paragraph three things a cement mason should know about a bag of cement.

9. Distinguish between cement and concrete by placing an "X" in front of the statement that properly describes cement.

______a. A manufactured product that goes into the making of concrete

______b. A material made from cement, sand, gravel, and water

HISTORY OF CEMENT
UNIT II

ANSWERS TO TEST

1. a. 6
   b. 3
   c. 5
   d. 7
   e. 1
   f. 9
   g. 8
   h. 2
   i. 4
   j. 10

2. Discussion should include:

   a. Word "cement" more than 2,000 years old

   b. Hydraulic cement produced in Holland in 1200 A.D.

   c. Eddystone lighthouse--First structure built with portland cement in 1756 by John Smeaton

   d. First structure built in America--Diversion dam in San Diego, California, about 1769

   e. Portland cement patented by Joseph Aspdin, 1824

   f. Portland cement named because of resemblance to stone on Isle of Portland

   g. 1868--First shipment of portland cement to United States

   h. Natural cement rock found in Rosendale, New York; Lehigh Valley, Pennsylvania; and Louisville, Kentucky

   i. First cement plant in United States in Coplay, Pennsylvania-- 1871, beginning of portland cement in America

   j. Robert W. Lesley--First president of P.C.A., also writer

   k. Allen House--Built in 1857, one of oldest structures in United States

   l. 50 cement companies that operate 170 plants with a total yearly capacity of 80-85 million tons of cement

3. a. 3

   b. 4

   c. 1

   d. 2

4. d

5. Any three of the following are acceptable.
    a. Lime
    b. Silica
    c. Alumina
    d. Iron ore
    e. Gypsum

6. b. Type

7. a. 2
    b. 1
    c. 5
    d. 3
    e. 4
    f. 6

8. Discussion should include:
    a. Packaged in paper bags
    b. Weighs 94 pounds
    c. Volume--1 cubic foot

9. a

APPLYING FOR A JOB
UNIT IV

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to locate a job opening, make formal application, and effectively interview for a job. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with a job application to the correct definitions.
2. List four means of locating job openings.
3. List three methods of applying for a job.
4. Select from a list ten items of information that may be asked for on an application.
5. Select from a list the personal attributes or attitudes an employer looks for during a personal interview.
6. Choose examples of proper conduct during the job interview.
7. Demonstrate the ability to:
    a. Write a letter of application for a cement mason's job.
    b. Make an appointment by phone for a cement mason's job interview.
    c. Write a resumé.
    d. Complete an application form for a job as a cement mason.
    e. Write a follow-up letter after an interview for a cement mason's job.

APPLYING FOR A JOB
UNIT IV

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information, assignment, and handout sheets.

  C. Provide student with poster board for role play activity.

  D. Make transparencies.

  E. Discuss terminal and specific objectives.

  F. Discuss information sheet.

  G. Discuss assignment sheets and handouts.

  H. Have students role play assignment sheets.

  I. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Role play assignment sheet.

  D. Complete assignment sheets.

  E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Attitudes

    2. TM 2--Take the Time to be on Time

    3. TM 3--Appropriate Dress

D. Assignment sheets

   1. Assignment Sheet #1--Write a Letter of Application

   2. Assignment Sheet #2--Make an Appointment by Phone

   3. Assignment Sheet #3--Prepare a Resumé

   4. Assignment Sheet #4--Complete an Application

   5. Assignment Sheet #5--Write a Follow-Up Letter

E. Student handouts

   1. Student Handout #1--Application for Employment

   2. Student Handout #2--Dear Kid

   3. Student Handout #3--Sample Letter of Application

   4. Student Handout #4--Sample Resumé

   5. Student Handout #5--Sample Follow-Up Letter

F. Test

G. Answers to test

II. References:

A. Blackledge-Blackledge-Keily. *You and Your Job.* Dallas, Texas: South-Western Publishing Company, 1967.

B. Milburn, Paul M. *How to Get a Job.* Shawnee, Oklahoma: Gordon Cooper Area Vocational Technical School, 1967.

C. Moynihan-Moynihan-Daeger. *You and Your Job: How to Get It.* Chicago: J. G. Ferguson Publishing Company, 1968.

D. Wood-McKeena. *The Receptionist.* Dallas, Texas: Gregg Division, McGraw-Hill Book Company, 1966.

E. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

APPLYING FOR A JOB
UNIT IV

INFORMATION SHEET

I. Terms and definitions

- A. Award--Recognition received for outstanding achievement
- B. Extracurricular activities--Clubs, organizations, and social or church groups in which one participates
- C. Fringe benefits--Extras provided by an employer, such as paid vacations, sick leave, and insurance protection
- D. Qualifications--Experience, education, and physical characteristics which suit a person to a job
- E. Resumé--Brief typed summary of one's qualifications and experience that is used in applying for a job
- F. Vocational preparation--Any vocational courses and skills one has learned in high school or through work experience

II. Means of locating a job opening

- A. Classified ads
    1. Newspapers
    2. Magazines
- B. Employment offices
    1. Department of Labor
    2. Private
- C. Local labor union business office
- D. School officials
    1. Teacher
    2. Counselor
    3. Principal

INFORMATION SHEET

III. Methods of applying for a job
  A. Letter
  B. Telephone
  C. In person

IV. Information that may be asked for on an application (Student Handout #1)
  A. Name and address
  B. Phone number
  C. Social security number
  D. Personal information
    1. Age
    2. Sex
    3. Height
    4. Weight
    5. Physical limitations
  E. Education
    1. Elementary
    2. High school
    3. College
    4. Other
  F. Experience (including military)
  G. Next of kin
  H. Previous employers
  I. Reason for leaving last job
  J. Type of job for which one is applying
  K. References
  L. Resumé (optional)

INFORMATION SHEET

V. Personal attributes or attitudes (Transparency 1)

- A. Enthusiasm and interest
- B. Dedication and dependability
- C. Alertness, quickness of mind
- D. Honesty, integrity, and pride
- E. Desire to work
- F. Desire to help others
- G. Desire to improve one's self

VI. Proper conduct during the interview (Transparencies 2 and 3; Student Handout #2)

- A. Greet interviewer with a warm smile
- B. Call interviewer by name (Mr., Mrs., or Miss Jones)
- C. Introduce self
- D. Shake interviewer's hand firmly
- E. Be seated only after interviewer has asked
- F. Sit and stand erect; do not lean against the wall, a chair, or the desk
- G. Do not put a hat or coat on the interviewer's desk
- H. Let the interviewer take the lead in the conversation
- I. Answer questions completely
- J. Be polite and courteous
    - 1. Do not interrupt
    - 2. Say "Yes, sir" or "No, sir"
- K. Have resumé available for quick reference

INFORMATION SHEET

- L. Make an extra effort to express one's self clearly and distinctly
    - 1. Take time to think through every answer
    - 2. Use proper grammar
    - 3. Do not swear
    - 4. Avoid use of slang
    - 5. Try to understand the interviewer's position
    - 6. Look the interviewer in the eye
- M. Be sincere and enthusiastic
- N. Avoid irritating or distracting habits
    - 1. Smoking, chewing gum, eating candy
    - 2. Giggling or squirming in chair
    - 3. Finger tapping and/or swinging a crossed leg
- O. Do not try to flatter the interviewer
- P. Tell the truth about qualifications and experiences
- Q. Speak well of former employers and associates
- R. Be positive
- S. Accept competition gracefully
- T. Watch for a sign that the interview is over
- U. Thank interviewer for his time
- V. Leave promptly at completion of interview

VII. Writing a letter of application (Student Handout #3)

- A. Standards for a letter of application
    - 1. Attractive form
    - 2. Logical arrangement of information
    - 3. Free from smudges or typographical errors

INFORMATION SHEET

4. Free from spelling or gramatical errors
5. Brief and to the point, leaving details for the resumé
6. Positive in tone
7. Clearly expressed ideas

B. Information to include in a letter of application

1. Type of position for which one is applying
2. Reason interested in position and firm
3. Ways one's training meets the employer's needs
4. Explanation of personal qualifications
5. Mention of resumé
6. Request for interview

(NOTE: Be sure to include an address and a phone number where you can be reached.)

VIII. Making an appointment for an interview by phone

A. Plan what to say before calling

B. State one's name and reason for calling

(NOTE: Remember that the receptionist is there to help you. Keep her on your side.)

C. Ask the best time to come for an interview

(NOTE: Do not ask over the phone how much the job pays.)

D. Record the day, time, and place for the interview

E. Thank the receptionist for her help

(NOTE: Be polite and courteous. Remember that this is your first contact with the firm. Make that first impression a good one.)

IX. Writing a resumé (Student Handout #4)

A. Standards for a resumé

1. Logically organized
2. Neatly typed

INFORMATION SHEET

3. Error free
4. In outline form
5. Limited to one page if possible
6. Honest listing of qualifications and experience

B. Information to include in a resumé

1. Name, address, and phone number
2. Recent photograph
3. Personal data
    a. Birth date
    b. Age, height, and weight
    c. Physical limitations
    d. Marital status
    e. Hobbies
4. Education
    a. Schools attended
    b. Dates of attendance
    c. Major field of study
    d. Awards and activities
5. Job preferences
6. Experience
    a. Name and address of company
    b. Length of time worked
    c. Brief description of duties and responsibilities
    d. Special training programs or courses

INFORMATION SHEET

7. References (usually three)

   (NOTE: Be sure to obtain permission before naming someone as a reference.)

X. Writing a follow-up letter (Student Handout #5)

   A. Standards for the follow-up letter

      1. Error free

      2. Clean, neat, and arranged attractively

      3. Free from spelling, punctuation, and grammatical errors

      4. Sent within a day or two after the interview

   B. Information to include in a follow-up letter

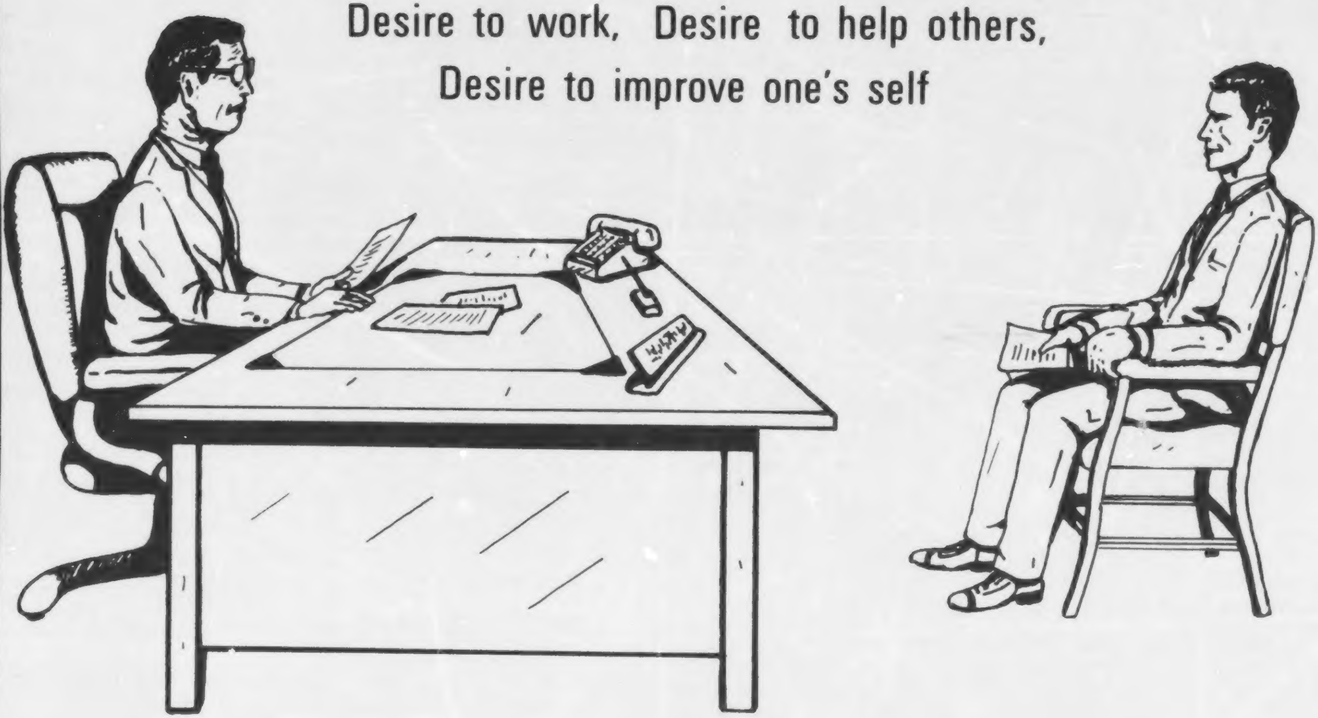
      1. An expression of appreciation for the interviewer's time and interest

      2. A summary of personal qualifications and interest in the position

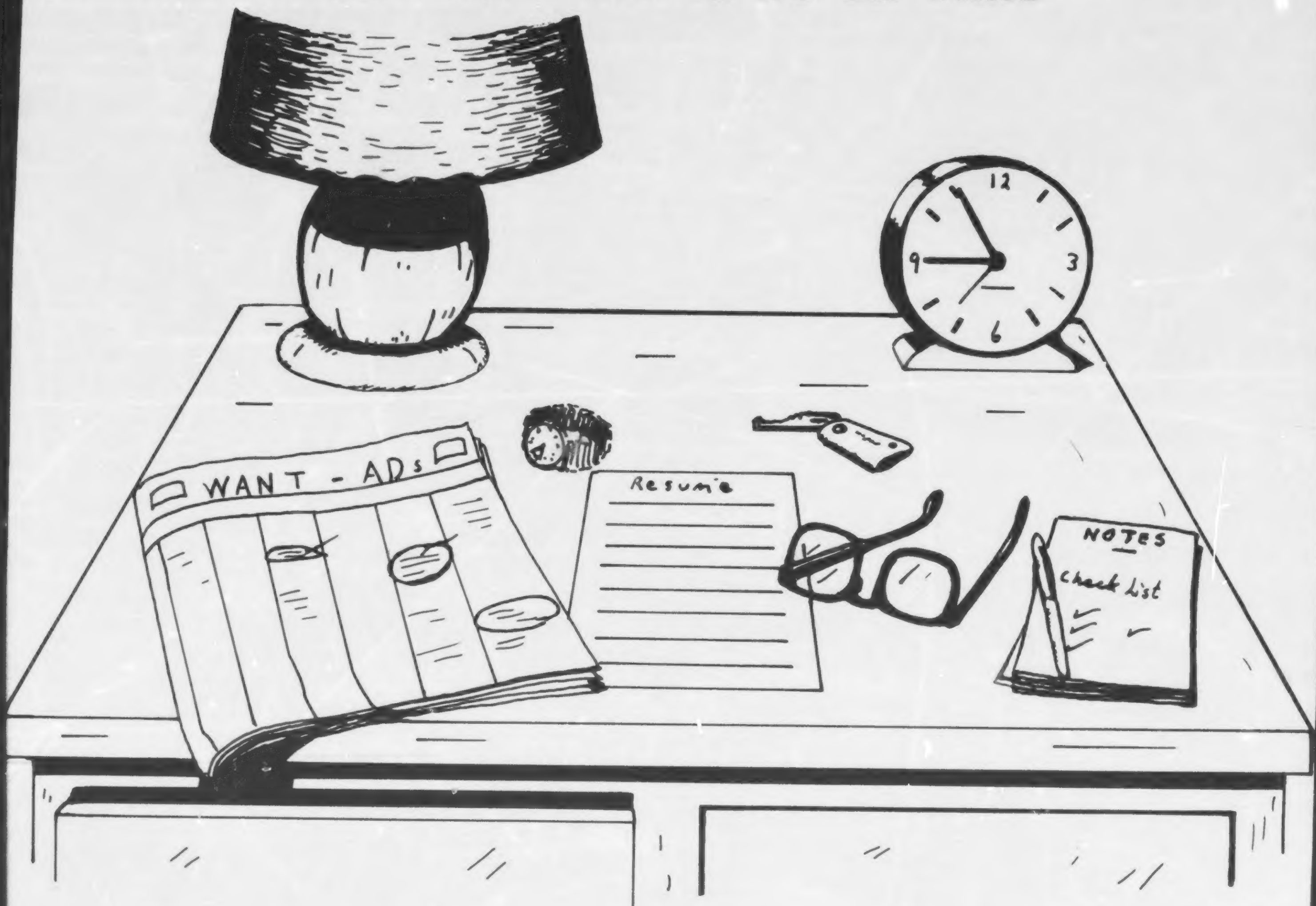
         (NOTE: Make this last bid for the job a prime example of your excellent work habits. Make the letter as clean, neat, and well-worded as possible.)

Attitudes

Enthusiasm, Interest, Dedication, Dependability,
Alertness, Quickness of mind, Honesty, Integrity,
Desire to work, Desire to help others,
Desire to improve one's self

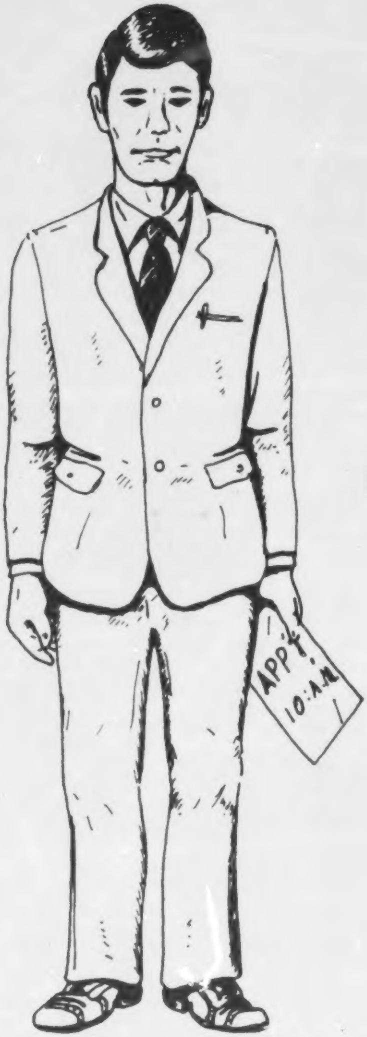


Take the Time to be on Time



12
3
6
9
WANT - ADs
Resume
NOTES
Check List

Appropriate Dress



Hair neat?

Friendly?

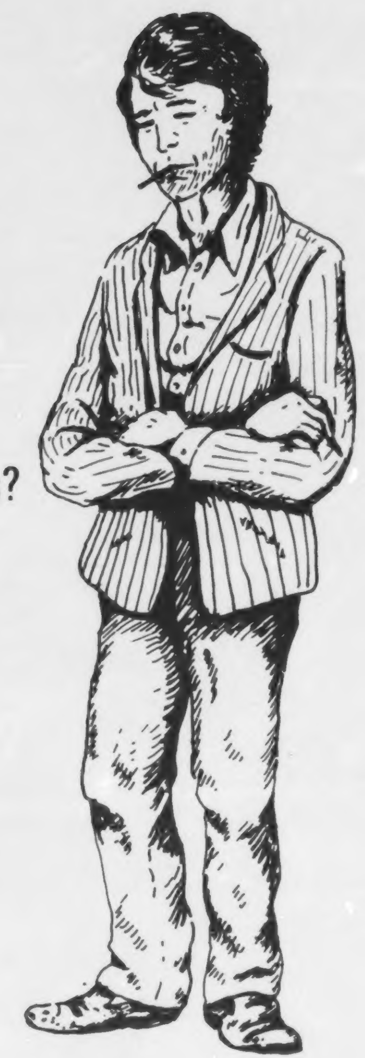
Clean shaven?

Clean and neat clothes?

Pen and paper?

On time?

Shoes shined?



APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #1--WRITE A LETTER OF APPLICATION

1. Write a letter of application to a prospective employer of cement masons. Use the sample letter in Handout #3 as a guide for composing the letter.

2. Make sure the letter meets the standards outlined in the information sheet.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #2--MAKE AN APPOINTMENT BY PHONE

1. Situation

   a. Applicant--Jones Construction Company has an opening for a job as a cement mason. The applicant must call and set up a time to interview for the job.

   b. Receptionist--The day, time, and place of the interview must be given to the applicant. The interview will be with Mr. John Jones, Personnel Director.

2. Directions for role playing

   a. Divide class into pairs

      1) Applicant

      2) Receptionist

   b. Discuss what should be said by each person and then make notes

   c. Place the chairs facing each other and position poster board so neither person sees the other

   (NOTE: If students prefer, they may place chairs back to back.)

   d. Role play the phone conversation, following the procedures outlined in the information sheet

   (NOTE: A tape recorder or video-tape equipment may be used if available. The recording could be replayed for class discussion on the good and bad points of the phone conversation.)

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #3--PREPARE A RESUMÉ

1. Write a resumé to be included with a letter of application. Use the example in Handout #4 as a guide.

2. Make sure this resumé meets the standards outlined in the information sheet.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #4--COMPLETE AN APPLICATION

View student Handout #1 as an application for employment as a cement mason. Fill in the required information being as honest and realistic as possible.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #5--WRITE A FOLLOW-UP LETTER

1. Write a follow-up letter to the prospective cement mason employer in Assignment Sheet #1. Use the sample letter in Handout #5 as a guide for composing the letter.

2. Make sure this letter meets the standards outlined in the information sheet.

APPLYING FOR A JOB
UNIT IV

STUDENT HANDOUT #1--APPLICATION FOR EMPLOYMENT

Date ____________ Position applied for ____________

Name ____________ Height ________ Weight ________ Age ________

Address ____________ Telephone No ____________
(Street or RFD) (City) (State)

Previous address ____________ Social Security No ____________

Birthdate ____________ Birthplace ____________
(Month) (Day) (Year) (City) (State)

CHECK ALL THAT APPLY

______ Female
______ Male
______ Single
______ Married
______ Widowed
______ Divorced
______ Separated

______ Own home
______ Rent
______ Board
______ Live (Parents)
______ With (Relatives)
______ Purchasing home

Number and age of dependents
____
Relationship of dependents
____
Business or occupations of father
____
(or Husband) ____________

Interested in Temporary work ____ Full time ______ Part time ______ Saturday only ______

Salary expected ____________

Are you responsible for your entire support? ________ Others who are dependent on you for ______ their support Number ______ Ages ____________

Nature of any physical defects ____________

Recent illnesses ____________

Date of last physical examination ____________

EDUCATION	Circle grade completed	Name of School	Location	Major Subject	Year Graduated
Elementary	1 2 3 4 5 6 7 8				
High	1 2 3 4				
Business or Vocational	1 2 3 4				
College or University	1 2 3 4 5 6				
Night or Correspondence	1 2 3 4				

Give details of any other educational training ____________

____

STUDENT HANDOUT #1

What are your hobbies? ______

In case of illness or emergency, notify: Name ______

Address ______

Relationship ______ Telephone ______

Why do you feel qualified for the position for which you are applying?

______

______

______

PREVIOUS EMPLOYMENT

(Last employment first)

From	To	Name & address of employer	Department position duties salary	Reason for Leaving
Month Year	Month Year			
Month Year	Month Year			
Month Year	Month Year			
Month Year	Month Year			

PERSONAL REFERENCES

(Do not give names of relatives or former employers)

Name	Address	Occupation
1.		
2.		
3.		

Do Not Write In Space Below

Interviewed by:

Personality ______

Attitude ______

Ambition and initiative ______

Other remarks:

Calmness ______

Physical qualities ______

Intelligence ______

Leadership ______

Appearance and grooming ______

Work best suited for ______

APPLYING FOR A JOB
UNIT IV

STUDENT HANDOUT #2--DEAR KID

Dear Kid:

Today you asked me for a job. From the look of your shoulders as you walked out, I suspect you've been turned down before, and maybe you believe by now that kids out of high school can't find work.

But, I hired a teen-ager today. You saw him. He was the one with the polished shoes and a necktie. What was so special about him? Not experience, neither of you had any. It was his attidude that put him on the payroll instead of you. Attitude son. ATTITUDE. He wanted that job badly enough to shuck the leather jacket, get a haircut, and look in the phone book to find out what this company makes. He did his best to impress me. That's where he edged you out.

You see, Kid, people who hire people aren't "with" a lot of things and we have some Stone Age ideas about who owes whom a living. Maybe that makes us prehistoric, but there's nothing wrong with the checks we sign, and if you want one you'd better tune to our wave length.

Ever hear of "empathy"? It's the trick of seeing the other fellow's side of things. I couldn't have cared less that you're behind in your car payments. That's your problem and the president's. What I needed was someone who'd go out in the plant, keep his eyes open, and work for me like he'd work for himself. If you have even the vaguest idea of what I'm trying to say, let it show the next time you ask for a job. You'll be head and shoulders over the rest.

Look kid. The only time jobs grew on trees was while most of the manpower was wearing G.I.'s and pulling K.P. For all the rest of history you've had to get a job like you get a girl: "Case" the situation, wear a clean shirt, and try to appear reasonably willing.

Maybe jobs aren't as plentiful right now, but a lot of us can remember when master craftsmen walked the streets. By comparison you don't know the meaning of "scarce."

You may not believe it, but all around you employers are looking for young men smart enough to go after a job in the old-fashioned way. When they find one, they can't wait to unload some of their worries on him.

For both our sakes, get eager, will you?

APPLYING FOR A JOB
UNIT IV

STUDENT HANDOUT #3--SAMPLE LETTER OF APPLICATION

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Anywhere, U.S.A. 77704

Dear Mr. Jones:

Please consider me for the job of cement mason that you advertised in the *Daily Chronicle*.

The skills I have learned in my high school cement masonry courses should qualify me for this job. I have had experience in all of the basic skills required in residential construction, including the safe use of power tools.

I will be graduating from high school in May, and I would like to become a cement mason. A more complete description of my qualifications is given in the enclosed resumé.

May I come for an interview any time at your convenience? I can be reached by phone at 377-3303 after 3:30 p.m. or by mail at 774 East Adams Street, Anywhere, U.S.A. 77704.

Sincerely yours,

James F. Smith

Encl. 1

APPLYING FOR A JOB
UNIT IV

STUDENT HANDOUT #4--SAMPLE RESUMÉ

Name: James L. Smith
Address: 774 E. Adams St., Anywhere, U.S.A. 77704
Telephone: 377-3303

Age: 18 years
Height: 6' 1"
Weight: 180 pounds
Health: Excellent
Marital Status: Single

Education: Expect to graduate from high school in May, 1973

Subjects Studied: Vocational cement mason's training--2 years (1080 hours)
Algebra--2 semesters
Geometry--2 semesters
Basic drafting--2 semesters

Student Activities: President, Senior class
President, VICA
Treasurer, Baptist Youth Fellowship

Work Experience: Cement mason's helper, Jones Construction Co., Summer, 1972
Vocational cement mason's class 1972-73, all phases of construction, Mr. Sammy Slavedriver, Instructor

References: Mr. Sammy Slavedriver
Cement Mason's Vocational Instructor
Anywhere High School
Anywhere, U.S.A. 77704

Mr. John Naildriver
Construction Foreman
Jones Construction Company
2330 Lake Shore Drive
Anywhere, U.S.A. 77704

Mr. Jimmie Smith
Youth Director
Park View Baptist Church
711 Fellowship Circle
Anywhere, U.S.A. 77704

Date compiled ______________________________

Signature ______________________________

APPLYING FOR A JOB
UNIT IV

STUDENT HANDOUT #5--SAMPLE FOLLOW-UP LETTER

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Anywhere, U.S.A. 77704

Dear Mr. Jones:

Thank you for interviewing me for the cement mason's job in your firm. I feel that working for Jones Construction Company would be enjoyable and that I could do the general concrete work that the job requires. I hope that I will have the opportunity to prove my worth.

The application form you gave me is enclosed.

I will be available for work May 15. You may call me at my home after 3:30 p.m. The number is 377-3303.

Sincerely yours,

James L. Smith

encl.

APPLYING FOR A JOB
UNIT IV

TEST

1. Match the terms associated with a job application to the correct definitions.

    ______a. Brief typed summary of one's qualifications and experience that is used in applying for a job

    ______b. Extras provided by an employer, such as paid vacations, sick leave, and insurance protection

    ______c. Recognition received for outstanding achievement

    ______d. Experience, education, and physical characteristics which suit a person to a job

    ______e. Any vocational courses and skills one has learned in high school or through work experience

    ______f. Clubs, organizations, and social or church groups in which one participates

    1. Award
    2. Extracurricular activities
    3. Fringe benefits
    4. Qualifications
    5. Resumé
    6. Vocational preparation

2. List four means of locating job openings.

    a.

    b.

    c.

    d.

3. List three methods of applying for a job.

    a.

    b.

    c.

4. Select from the list below ten items of information that may be asked for on an application. Circle the correct letters.

   a. Race

   b. Name and address

   c. Phone number

   d. Shoe size

   e. Age

   f. Education

   g. Number of brothers and sisters

   h. Experience

   i. Next of kin

   j. Make and model of car

   k. Previous employers

   l. Reason for leaving last job

   m. Whether you are left or right handed

   n. Type of job for which you are applying

   o. References

5. Select from the list below seven personal attributes or attitudes that an employer looks for during a personal interview. Circle the correct letters.

   a. Alertness

   b. Long wavy hair

   c. Dedication and dependability

   d. Enthusiasm and interest

   e. New car

   f. Honesty, integrity, and pride

   g. Desire to work

   h. Beard

   i. Flashy clothes

j. Desire to help others

k. Desire to improve one's self

6. Choose from the list below ten examples of proper conduct during an interview. Circle the correct letters.

a. Arrive five minutes late, giving the impression that one is busy

b. Sit and stand erect

c. Call interviewer by his or her first name

d. Answer questions completely

e. Put a hat or coat on the interviewer's desk

f. Greet interviewer with a warm smile

g. Sit down immediately upon entering the room

h. Shake the interviewer's hand firmly

i. Be polite and courteous

j. Use all of the cute slang expressions

k. Look the interviewer in the eye

l. Be sincere and enthusiastic

m. Thank the interviewer for his time

n. Chain smoke, giving the impression of being a real "he-man"

o. Speak well of former employees

p. Flatter the interviewer

q. Leave promptly at completion of interview

7. Demonstrate the ability to:

a. Write a letter of application for a cement mason's job.

b. Make an appointment by phone for a cement mason's job interview.

c. Write a resumé.

d. Complete an application form for a job as a cement mason.

e. Write a follow-up letter after an interview for a cement mason's job.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

APPLYING FOR A JOB
UNIT IV

ANSWERS TO TEST

1. a. 5 d. 4
   b. 3 e. 6
   c. 1 f. 2
2. a. Classified ads
   b. Employment offices
   c. Local labor union business office
   d. School officials
3. a. Letter
   b. Telephone
   c. In person
4. b, c, e, f, h, i, k, l, n, o
5. a, c, d, f, g, j, k
6. b, d, f, h, i, k, l, m, o, q
7. Performance skills evaluated to the satisfaction of the instructor.

CEMENT MASON'S

PROGRESS CHART

Section A
Related Information

Student's Name	UNIT I Orientation			UNIT II Safety			UNIT III History of Cement			UNIT IV Applying for a Job										
Job	1	2	3	1	2	3	1	2	3	1	2	3								
	UNIT TEST			UNIT TEST			UNIT TEST			UNIT TEST										
1																				
2																				
3																				
4																				
5																				
6																				
7																				

8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
Accuracy	85% Correct			85% Correct			85% Correct			85% Correct										

CONCRETE INGREDIENTS
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to discuss what makes good concrete. He should be able to name the different sizes of aggregates and the safety rules for working with concrete. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with concrete ingredients to the correct definitions.
2. State the reasons for using water in concrete.
3. Select from a list three common impurities in water.
4. List the effects of impure water on concrete.
5. Discuss in a few words when water is pure enough to use in mixing concrete.
6. Name three types of aggregates.
7. List the two classifications of aggregates.
8. Choose from a list the number that determines the maximum size of fine aggregate.
9. Select from a list the sizes of the most common coarse aggregates used in concrete.
10. State the reasons for using aggregates in concrete.
11. Discuss in a few words what makes good concrete.
12. Name the approximate weight of a cubic yard of normal concrete.
13. List the purposes of using sand in concrete.
14. Name three undesirable aggregates.
15. List the types of contaminants that make aggregate unfit for concrete.
16. State what is meant by gradation of aggregates.
17. List the basic safety rules when working with concrete.

CONCRETE INGREDIENTS
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide each student with objective sheet.
- B. Provide each student with information sheet.
- C. Make transparencies.
- D. Discuss the terminal and specific objectives.
- E. Discuss information sheet.
- F. Show samples of materials.
- G. Visit a concrete batch plant.
- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Types of Aggregates
  2. TM 2--Classifications of Aggregates
  3. TM 3--Fine and Coarse Aggregate
  4. TM 4--Good Concrete
  5. TM 5--Gradation of Aggregates
- D. Test
- E. Answers to test

CONCRETE INGREDIENTS
UNIT I

INFORMATION SHEET

I. Terms and definitions

  A. Aggregate--Material used for mixing with cementing materials to make concrete

  B. Cement--Manufactured product consisting of lime, silica, alumina, iron, and gypsum that are finely ground and mixed together

  C. Concrete--Mixture of cement, sand, gravel, and water

  D. Hydration--As the water leaves the concrete, it sets up a chemical reaction that causes the concrete to harden and set

  E. Set--Actual hardening of concrete

  F. Cement paste--Mixture of cement and water that forms a bond between the aggregates

  G. Retard--To slow down the set of concrete

  H. Accelerate--To speed up the set of concrete

  I. Pockets--Voids in concrete

  J. Gradation--Separation of aggregate into various sizes

II. Reasons for using water in concrete

  A. Hydration

  B. Workability

III. Impurities in water

  A. Salt

  B. Minerals

  C. Industrial waste

  D. Sugar

  E. Algae

INFORMATION SHEET

IV. Effects of impure water on concrete

- A. Retards set
- B. Accelerates set
- C. Reduces bond
- D. Corrodes steel

V. Water is pure enough to use in mixing concrete when it is drinkable and has no pronounced taste or odor

VI. Types of aggregates (Transparency 1)

- A. Sand
- B. Gravel
- C. Crushed stone

VII. Classifications of aggregates (Transparency 2)

- A. Fine
- B. Coarse

VIII. Maximum size of fine aggregate--One quarter inch; less in some mixtures; determined by sieve analysis (Transparency 3)

IX. Sizes of the most common coarse aggregates (Transparency 3)

- A. 3/8--Three eighths inch
- B. 1/2--One half inch
- C. 3/4--Three quarter inch
- D. 1--One inch
- E. 1 1/2--One and one half inches
- F. 2--Two inches

X. Reasons for using aggregates in concrete

- A. Strength
- B. Durability
- C. Reduces shrinkage

(NOTE: Aggregate makes up sixty to eighty percent of the volume of concrete.)

INFORMATION SHEET

XI. Good concrete--Concrete with all the aggregate completely covered or surrounded by cement paste (Transparency 4)

XII. Approximate weight of a cubic yard of normal concrete--Generally weighs 4,000 pounds but weight can vary

XIII. Purposes of using sand in concrete

- A. To fill the voids between the coarse aggregates
- B. Workability

XIV. Undesirable aggregates

- A. Soft
- B. Flakey
- C. Poorly shaped

(NOTE: Undesirable aggregates wear too rapidly and, therefore, reduce the strength.)

XV. Types of contaminants that make aggregate unfit for concrete

- A. Dust
- B. Loam
- C. Silt
- D. Clay
- E. Organic matter

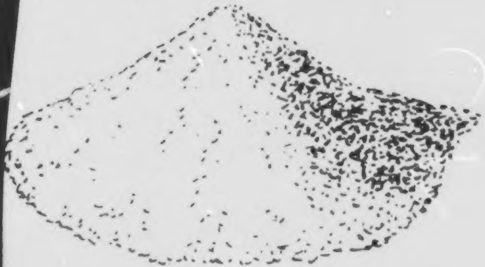
(NOTE: Aggregates that contain contaminants will not properly bond with cement paste, therefore, creating weak concrete.)

XVI. Gradation of aggregates--Aggregates must be proportioned so that the finer particles will fill the spaces between the larger ones (Transparency 5)

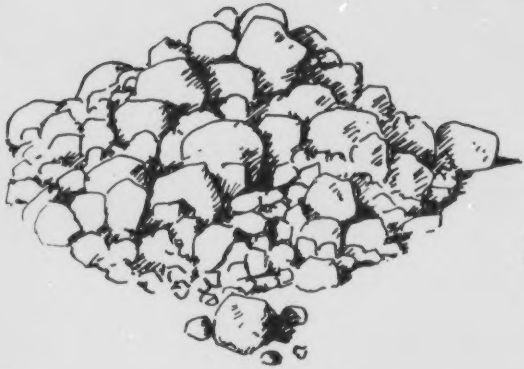
XVII. Basic safety rules when working with concrete

- A. Wear gloves
- B. Wear boots or overshoes
- C. Wear proper clothes
- D. Wear goggles and skin and face protection
- E. Wear safety helmet

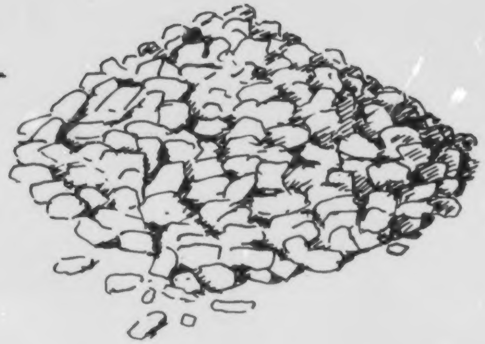
Types of Aggregates



Sand



Gravel



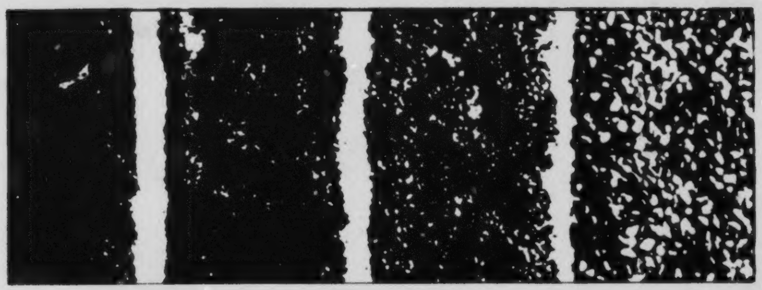
Crushed Stone

Classifications of Aggregates

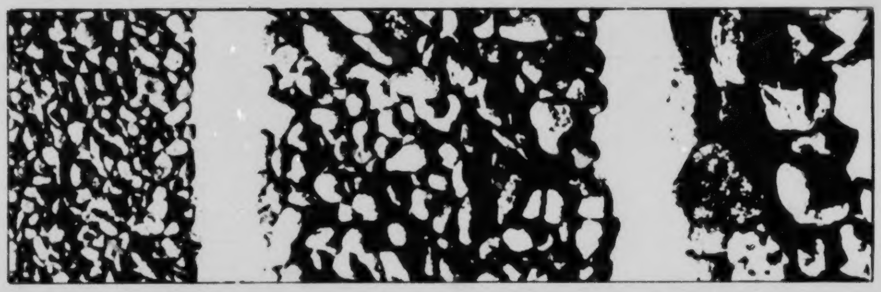
Fine

Coarse

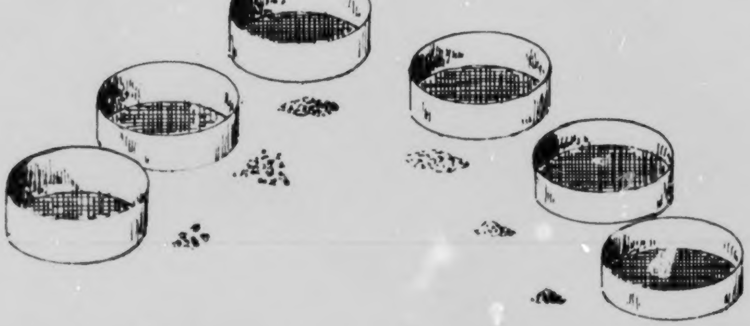
Fine and Coarse Aggregates



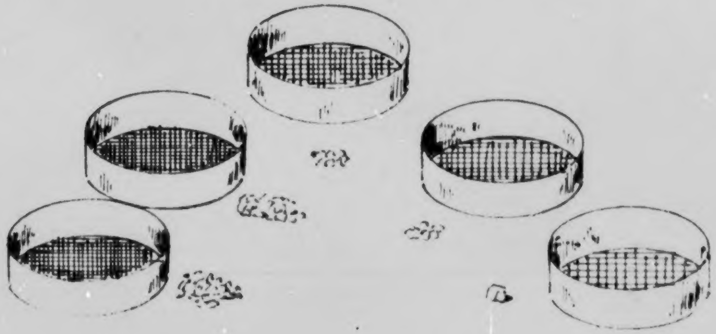
Fine



Coarse

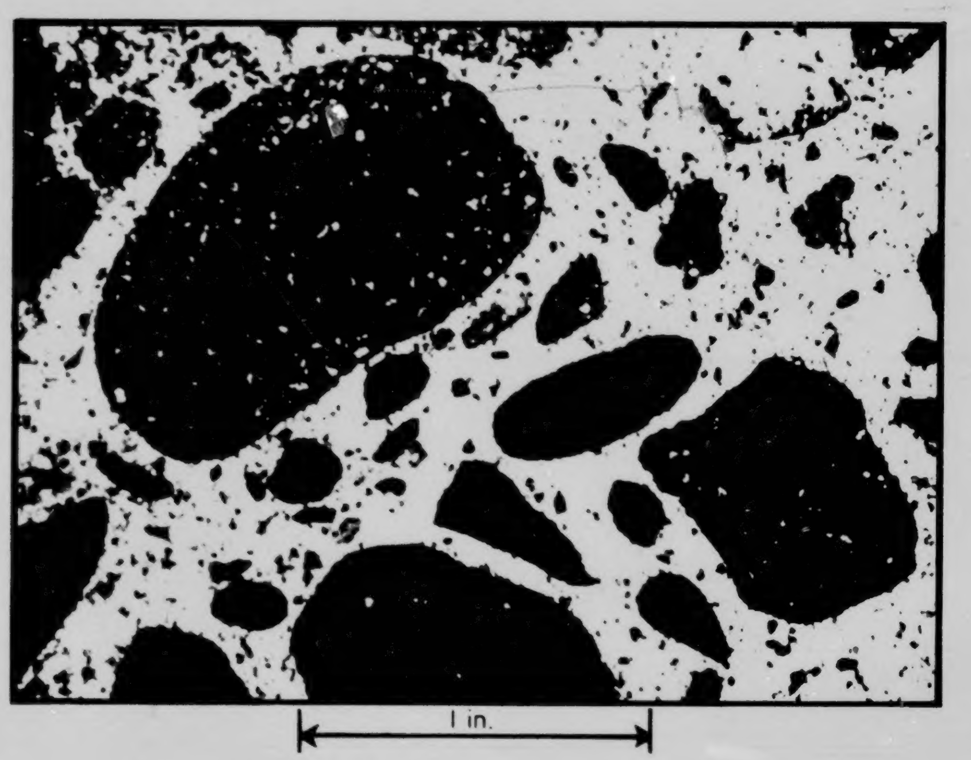


Sieve for Analyzing Fine Aggregate



Sieve for Analyzing Coarse Aggregate

Good Concrete



Cross-section of concrete. Cement and water paste completely coats each aggregate particle and fills all of the space between particles.

Gradation of Aggregates

Well-Graded Aggregate

CONCRETE INGREDIENTS
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

    _____a. To speed up the set of concrete

    _____b. As the water leaves the concrete, it sets up a chemical reaction that causes the concrete to harden and set

    _____c. Manufactured product consisting of lime, silica, alumina, iron, and gypsum that are finely ground and mixed together

    _____d. To slow down the set of concrete

    _____e. Mixture of cement and water that forms a bond between the aggregates

    _____f. Actual hardening of concrete

    _____g. Mixture of cement, sand, gravel, and water

    _____h. Material used for mixing with cementing materials to make concrete

    _____i. Voids in concrete

    _____j. Separation of aggregate into various sizes

    1. Retard
    2. Set
    3. Aggregate
    4. Concrete
    5. Accelerate
    6. Cement
    7. Hydration
    8. Cement paste
    9. Gradation
    10. Pockets

2. State the two reasons for using water in concrete.

    a.

    b.

3. Select three common impurities in water from the list below. Circle the correct letters.

    a. Salt

    b. Fine aggregate

    c. Minerals

    d. Industrial waste

    e. Chlorine

4. List three effects of impure water on concrete.

   a.

   b.

   c.

5. Discuss in a few words when water is pure enough to use in mixing concrete.

6. Name three types of aggregates.

   a.

   b.

   c.

7. List the two classifications of aggregates.

   a.

   b.

8. Choose from the list below the number that determines the maximum size of fine aggregate. Circle the correct letter.

   a. Three eighths

   b. One eighth

   c. Three quarters

   d. One quarter

9. Select from the list below three specific sizes of the most common coarse aggregates used in concrete. Circle the correct letters.

   a. Three quarter inch

   b. One quarter inch

   c. One eighth inch

   d. One inch

   e. Two inches

   f. Nine inches

10. State the reasons for using aggregates in concrete.

    a.

    b.

    c.

11. Discuss in a few words what makes good concrete.

12. Name the approximate weight of a cubic yard of normal concrete.

13. List two purposes of using sand in concrete.

    a.

    b.

14. Name three undesirable aggregates.

    a.

    b.

    c.

15. List three types of contaminants that make aggregate unfit for concrete.

    a.

    b.

    c.

16. State what is meant by gradation of aggregates.

17. List five basic safety rules when working with concrete.

    a.

    b.

    c.

    d.

    e.

CONCRETE INGREDIENTS
UNIT I

ANSWERS TO TEST

1. a. 5
   b. 7
   c. 6
   d. 1
   e. 8
   f. 2
   g. 4
   h. 3
   i. 10
   j. 9
2. a. Hydration
   b. Workability
3. a, c, d
4. Any three of the following are acceptable.
   a. Retards set
   b. Accelerates set
   c. Reduces bond
   d. Corrodes steel
5. When water is drinkable and has no pronounced taste or odor
6. a. Sand
   b. Gravel
   c. Crushed stone

7. a. Fine
   b. Coarse
8. d
9. a, d, e
10. a. Strength
    b. Durability
    c. Reduces shrinkage
11. All the aggregate completely covered or surrounded by cement paste
12. 4000 pounds
13. a. To fill the voids between the coarse aggregates
    b. Workability
14. a. Soft
    b. Flakey
    c. Poorly shaped
15. Any three of the following are acceptable.
    a. Dust
    b. Loam
    c. Silt
    d. Clay
    e. Organic matter
16. Aggregates must be proportioned so that the finer particles will fill the spaces between the larger ones
17. a. Wear gloves
    b. Wear boots or overshoes
    c. Wear proper clothes
    d. Wear goggles and skin and face protection
    e. Wear safety helmet

MIXING CONCRETE
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name factors that control a designed mix and match groups of lightweight concrete to their ingredients. He should be able to discuss the difference between rich mix and lean mix. He should be able to match designed mixes to non-air-entrained and air-entrained concrete. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with mixing concrete to the correct definitions.
2. Name the achievements of correctly designed mix.
3. Name the qualities of hardened concrete.
4. Name the factors affecting quality of hardened concrete.
5. Select from a list factors to consider before designing a mix.
6. Name the factors that affect the economy of mix design.
7. Name four factors to consider before determining satisfactory mix proportions.
8. Discuss in a few words optimum mix proportions.
9. Select from a list the factors influencing the selection of mix proportions.
10. Match the moisture allowances in aggregates to the types of aggregates.
11. Discuss in a few words the difference between rich mix and lean mix.
12. Match designed mixes to non-air-entrained or air-entrained concrete.
13. Select from a list the required mixing time of concrete.
14. Select from a list the allowable delivery and discharge time for concrete.
15. Name the special types of concrete.
16. Select from a list the approximate weight range of lightweight concrete.

17. Select from a list the approximate weight range of heavyweight concrete.

18 Match the groups of lightweight concrete to their ingredients.

19. Name the types of jobs where lightweight insulating concrete is used.

20. Name the types of jobs where structural lightweight concrete is used.

21. Discuss in a few words the uses of heavyweight concrete.

22. Select from a list five aggregates used in heavyweight concrete.

23. Name the factors that determine the selection of aggregate for heavyweight concrete.

24. Name the factors that determine the size of coarse aggregate.

25. Select from a list rules that limit the size of aggregate used in concrete.

MIXING CONCRETE
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Maximum Permissable Water/Cement Ratios for Different Types of Structures and Degrees of Exposure

      2. TM 2--Maximum Permissable Water/Cement Ratios for Concrete

      3. TM 3--Approximate Mixing Water Requirements for Different Slumps and Maximum Sizes of Aggregates

      4. TM 4--Air Content for Air-Entrained Concrete

      5. TM 5--Typical Slump Ranges for Various Types of Construction

6. TM 6--Sample of Trial Mix Data
7. TM 7--Consistency of Sand
8. TM 8--Ratio of Concrete Mixes
9. TM 9--Disharge Time of Concrete

D. Test

E. Answers to test

II. References:

A. Portland Cement Association. *Concrete Technology: Student Manual.* Albany, New York: Delmar Publishers, 1965.

B. Riles, Wilson. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1968.

C. "Fundamental Facts About Concrete," *Concrete Information.* Skokie, Illinois: Portland Cement Association, 1966.

D. "Special Types of Concrete," *Concrete Report.* Skokie, Illinois: Portland Cement Association, 1968.

MIXING CONCRETE
UNIT II

INFORMATION SHEET

I. Terms and definitions

   A. Economy--Minimizing the amount of cement required at the least cost and without sacrificing quality

   B. Workability--Ease with which concrete can be placed and consolidated

   C. A.S.T.M.--American Society for Testing and Materials

   D. Ratio--Amount of each ingredient used in a concrete mixture

   E. Slump--Consistency of concrete

   F. Perlite--Volcanic glass that has a concentric shelly structure and, when expanded by heat, forms a lightweight aggregate

   G. Vermiculite--Micaceous mineral that is a hydrous silicate derived usually from alteration of mica; when expanded by heat, forms lightweight aggregate

   H. Calcining--To alter composition or physical state by heating

   I. Sintering--To become coherent mass by heating without melting

   J. Diatomite--Light, easily broken, siliceous material resembling chalk

   K. Fly ash--Finely-divided residue that results from the combustion of ground or powdered coal transported from the firebox through the boiler by flue gases

   L. Pumice--Volcanic glass full of cavities and very light in weight

   M. Scoria--Refuse from melting of metals; the slag

   N. Tuff--Rock composed of the finer kinds of volcanic disintegrations

   O. Gamma ray--Radiation quantum emitted spontaneously by a radioactive substance

   P. Neutron radiation--Uncharged elementary particle that has a mass nearly equal to that of a proton

   Q. Barite--Barium sulfate occurring as a mineral

   R. Ferrophosphorous--Iron containing phosphorous

   S. Goethite--Mineral that consists of an iron hydrogen oxide

INFORMATION SHEET

- T. Hematite--Mineral constituting an important iron ore and occurring in crystals or in a red earthy form
- U. Ilmenite--Usually massive iron-black mineral composed of iron, titanium, and oxygen
- V. Limonite--Native hydrous ferric oxide of variable composition that is a major ore of iron
- W. Magnetite--Black isometric mineral that is an oxide of iron
- X. Steel shots and punchings--Scrap pellets or discs produced from metal punch presses
- Y. Structural lightweight concrete--Concrete made from lightweight aggregate where lightness in weight and compressive strength are of prime concern
- Z. Insulating lightweight concrete--Concrete made from lightweight aggregate that has good fire resistance and insulation against heat and sound
- AA. Heavyweight concrete--Concrete made from heavyweight aggregate to increase the unit weight but also to decrease the size of the units required to absorb or slow down radiation

II. Achievements of correctly designed mix

- A. Required qualities of hardened concrete
- B. Workability of fresh concrete
- C. Economy

III. Qualities of hardened concrete

- A. Durability
- B. Wear resistance
- C. Strength
- D. Water tightness

IV. Factors affecting quality of hardened concrete (Transparency 1)

- A. Water/cement ratio
- B. Aggregate
- C. Entrained air
- D. Curing

INFORMATION SHEET

V. Factors to consider before designing a mix

   A. Size

   B. Shape

   C. Required strength

   D. Exposure conditions

VI. Economy of mix design

   A. Stiffest practical mixture

   B. Largest aggregate practical

   C. Optimum ratio of fine to coarse aggregate

VII. Determining satisfactory mix proportions (Transparencies 2, 3, 4, and 5)

   A. Water/cement ratio

   B. Maximum size of aggregate

   C. Air content

   D. Range of slump

VIII. Optimum mix proportions (Transparency 6)

   A. Small sample batches made with laboratory precision

   B. Job-size batches made during the course of normal concrete production

IX. Factors influencing selection of mix proportions

   A. Workability

   B. Strength

   C. Durability

   D. Cost

X. Allowance for moisture in aggregates (Transparency 7)
(NOTE: Additional mix water is needed based on the cubic yardage.)

   A. Dry--Six or seven gallons

   B. Damp--Five and one-half gallons

INFORMATION SHEET

C. Wet--Five gallons

D. Very wet--Four and one-half gallons

XI. Rich mix vs. lean mix (Transparency 8)

A. Rich mix

1. More cement and water

2. Less coarse aggregate

B. Lean mix

1. Less cement and water

2. More coarse aggregate

XII. Non-air-entrained vs. air-entrained concrete in relation to designed mixes

A. Rich mix

1. Air-entrained--Less air content

2. Non-air-entrained--More water and a little more fine aggregate

B. Lean mix

1. Air-entrained--Same material with an increase in air content

2. Non-air-entrained--Same material but with less air content

XIII. Mixing time of concrete--One minute for stationary mixes up to one cubic yard capacity

(NOTE: There should be an increase of fifteen seconds for each additional yard or fraction thereof. Mixing time is specified in the specifications.)

XIV. Delivery and discharge time for concrete (Transparency 9)

A. Within one and one-half hours after the introduction of water

B. Before the drum has revolved three hundred times

(NOTE: This is regulated by A.S.T.M.)

INFORMATION SHEET

XV. Special types of concrete

- A. Lightweight insulating concrete
- B. Structural lightweight concrete
- C. Heavyweight concrete

  (NOTE: There are many special types of concrete.)

XVI. Approximate weight range of lightweight concrete--From fifteen to ninety pounds per cubic foot

XVII. Approximate weight range of heavyweight concrete--In excess of 150 pounds per cubic foot

XVIII. Groups of lightweight concrete and their ingredients

- A. Group I--Made with aggregates and expanded materials, such as perlite and vermiculite
- B. Group II--Made with aggregates manufactured by expanding, calcining, or sintering materials
- C. Group III--Made by incorporating in a cement paste or cement/sand ratio a uniform cellular structure of air voids

XIX. Jobs where lightweight insulating concrete is used

- A. Roofs
- B. Firewalls
- C. Floor fills
- D. Underground thermal conduit linings

XX. Jobs where structural lightweight concrete is used

- A. Floors
- B. Structural members of high-rise buildings
- C. Many areas where regular concrete is used

XXI. Uses of heavyweight concrete

1. As a shielding material to protect men and equipment from harmful effects of x-rays, gamma rays, and neutron radiation
2. On floors where hard wearing is needed

INFORMATION SHEET

XXII. Aggregates used in heavyweight concrete

- A. Barite
- B. Ferrophosphorus
- C. Goethite
- D. Hematite
- E. Ilmenite
- F. Limonite
- G. Magnetite
- H. Steel shot and punchings

XXIII. Factors that determine the selection of aggregates for heavyweight concrete

- A. Physical properties
- B. Availability
- C. Cost

XXIV. Factors that determine the size of coarse aggregate

- A. Size and shape of concrete members
- B. Amount and distribution of reinforcing steel

XXV. Rules that limit the size of aggregate

- A. One-fifth the dimension of nonreinforced members
- B. Three-fourths the clear spacing between reinforcing bars or between bars and forms
- C. One-third the depth of nonreinforced slabs on grade

Maximum Permissable Water/Cement Ratios for Different Types of Structures and Degrees of Exposure

Type of structure	Exposure conditions					
	Severe wide range in temperature or frequent alterations of freezing and thawing (air-entrained concrete only)			Mild temperature rarely below freezing or rainy or arid		
	In air	At the water line or within the range of fluctuating water level or spray		In air	At the water line or within the range of fluctuating water level or spray	
		In fresh water	In sea water or in contact with sulfates		In fresh water	In sea water or in contact with sulfates
A. Thin sections such as reinforced piles and pipe	5.5	5.0	4.5	6	5.5	4.5
B. Thin sections such as railings, curbs, sills, ledges, ornamental or architectural concrete and all sections with less than 1-in. concrete cover over reinforcement	5.5	–	–	6	5.5	–
C. Moderate sections, such as retaining walls, abutments, piers, girders, beams	6.0	5.5	5.0	–	6.0	5.0
D. Exterior portions of heavy (mass) sections	6.5	5.5	5.0	–	6.0	5.0
E. Concrete deposited by tremie under water	–	5.0	5.0	–	5.0	5.0
F. Concrete slabs laid on the ground	6.0	–	–	–	–	–
G. Concrete protected from the weather, interiors of buildings, concrete below ground	–	–	–	–	–	–
H. Concrete which will later be protected by enclosure or backfill but which may be exposed to freezing and thawing for several years before such protection is offered	6.0	–	–	–	–	–

Maximum Permissable Water/Cement Ratios for Concrete

Specified compressive strength at 28 days, psi	Water required per 94-lb. bag of cement, U.S. gallons	
	Nonair-entrained concrete	Air-entrained concrete
2,500	7-1/4	6-1/4
3,000	6-1/2	5-1/4
3,500	5-3/4	4-1/2
4,000	5	4

Ratios include allowance for free moisture on the aggregate

Approximate Mixing Water Requirements for Different Slumps and Maximum Sizes of Aggregates

Slump, in.	Water, gal. per cu. yd. of concrete for indicated maximum sizes of aggregate							
	3/8 in.	1/2 in.	3/4 in.	1 in.	1-1/2 in.	2 in.	3 in.	6 in.
Air-entrained concrete								
1 to 2	37	36	33	31	29	27	25	22
3 to 4	41	39	36	34	32	30	28	24
5 to 6	43	41	38	36	34	32	—	—
Recommended average total air content, percent	7.5	7.5	6	6	5	5	4	3
Non-air-entrained concrete								
1 to 2	42	40	37	36	33	31	29	25
3 to 4	46	44	41	39	36	34	32	28
5 to 6	49	46	43	41	38	36	—	—
Approximate amount of entrapped air in non-air-entrained concrete, percent	3	2.5	2	1.5	1	0.5	0.3	0.2

Air Content for Air-Entrained Concrete

Maximum size of coarse aggregate, inch	Air content, percent by volume
1-1/2, 2, or 2-1/2	5±1
3/4 or 1	6±1
3/8 or 1/2	7-1/2±1

Typical Slump Ranges for Various Types of Construction

Types of Construction	Slump, in.*	
	Maximum	Minimum
Reinforced foundation walls and footings	4	2
Unreinforced footings, caissons, and substructure walls	3	1
Reinforced slabs, beams, and walls	5	2
Building columns	5	3
Pavements	2	1
Sidewalks, driveways, and slabs on ground	4	2
Heavy mass construction	2	1

*When high-frequency vibrators are not used, the values may be increased by about 50 per cent, but in no case should the slump exceed 6 in.

Sample of Trial Mix Data

STRUCTURE:______________________

EXPOSURE CONDITION:
Severe or Moderate_____ Mild_____

In Air____
In Fresh Water____
In Sea Water____

TYPE OF STRUCTURE (A-H):_________

MAX. W/C FOR EXPOSURE:____gal./bag

MAXIMUM SIZE AGGREGATE:__________

AIR CONTENT_______ % ± 1 %

DESIRED SLUMP RANGE
Max.____in. Min.____in.

STRENGTH REQUIREMENT____psi

W/C FOR STRENGTH:____to____gal./bag

USE W/C______________gal./bag

DATA FOR TRIAL BATCH
(Saturated, surface-dry aggregates)

(1) Material	(2) Initial Wt. (lb.)	(3) Final Wt. (lb.)	(4) Wt. Used (lb.)	(5) Wt. for 1-bag Batch	(6) Wt. per cu. yd.	(7) REMARKS
Cement						Cement Factor = bag/cu.yd.
Water						gal./cu.yd.
Fine Agg.						% of total aggregate
Coarse Agg.						
Air-Entraining Admixture			TOTAL (T) =			

Measured Slump:________in. Air Content_________ % Workability:__________

Wt. Container + concrete (lb.)	
Wt. Container (lb.)	
Wt. Concrete = A (lb.)	
Vol. Container = B (cu.ft.)	

Unit Wt. of concrete = w = $\frac{A}{B}$

$\frac{A}{B}$ = ________ = ________ lb./cu. ft.

Yield = $\frac{T}{w}$ = _______ = _______ cu.ft./bag

CALCULATIONS:

Column (4) = Column (2) minus Column (3)
Column (5) = Column (4) times (94 ÷ Wt. of Cement Used)

$$\text{Yield} = \frac{\text{Total Wt. of material for 1-bag batch (T)}}{\text{Unit wt. of concrete (w)}}$$

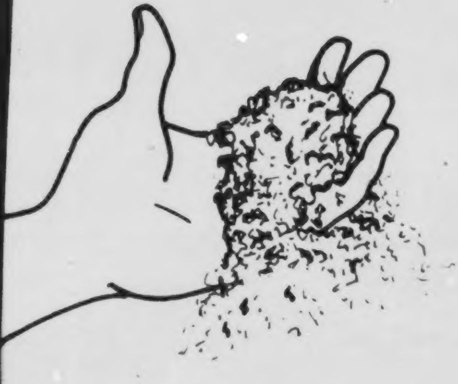
Cement factor = 27 ÷ yield
Column (6) = Column (5) times cement factor

$$\text{Gal./cu. yd.} = \frac{\text{(Cement factor) X (wt. of water for 1-bag batch)}}{\text{8.33 (lb. of water per gal.)}}$$

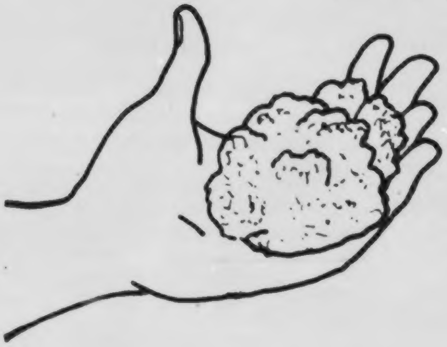
$$= \text{(Cement factor) X (W/C)}$$

Consistency of Sand

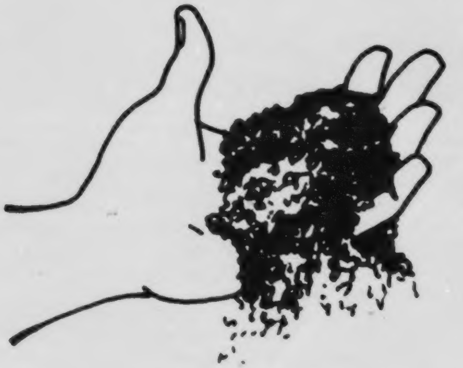
If mix calls for:	Use these amounts of mixing water, in gallons, when sand is:		
	Damp	Wet	Very wet
6 gal. per sack of cement	5½	5	4¼
7 gal. per sack of cement	6¼	5½	4¾



If Sand Falls Apart it is Damp

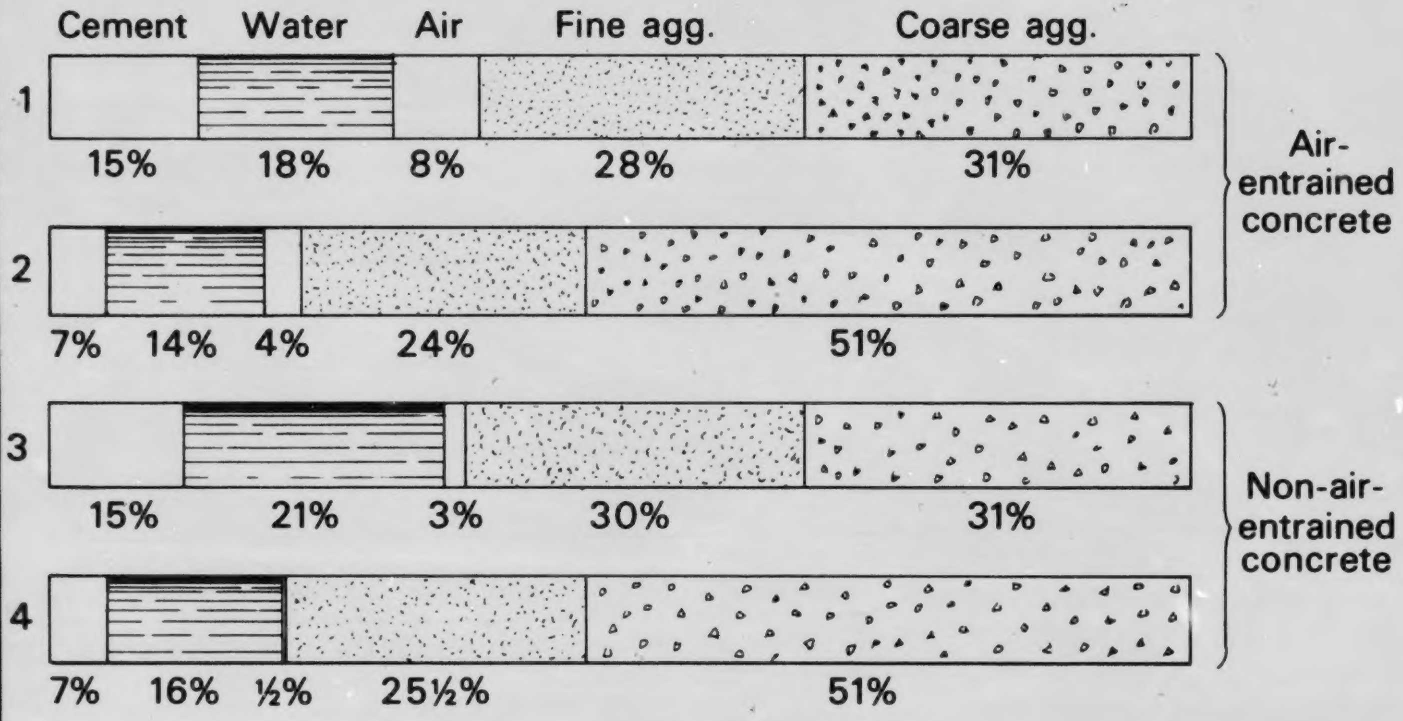


If Sand Forms a Ball it is Wet



If Sand Sparkles and Wets the Hand it is Very Wet

Ratio of Concrete Mixes



Range in proportions of materials used in concrete.
Bars 1 and 3 represent rich mixes with small aggregates.
Bars 2 and 4 represent lean mixes with large aggregates.

Discharge Time of Concrete

TEST NO.	NUMBER OF REVOLUTIONS			7 DAY-*		28 DAY-*		WT. FT. 3	TOTAL AIR %	SLUMP INS.	YIELD FT. 3/ YD. 3
	e4RPM (AGITATE)	e12RPM (MIX)	TOTAL REVS.	PSI	% LOSS	PSI	% LOSS				
1	84	0	8	1920	40	2400	40	146.5	2.9	1.00	26.08
2	84	20	104	2080	35	2800	30	145.7	3.2	1.25	26.22
3	84	40	124	2270	29	3000	25	145.0	3.5	1.75	26.34
4	84	50	134	2420	24	3210	20	143.8	4.4	2.50	26.56
5	84	70	154	3200	0	4010	0	141.0	6.0	4.00	27.09

* - AVERAGE OF 2-6" x 12" CYLINDERS, CARDBOARD MOLDS, STANDARD MOIST CURING

Concrete batched out of dry-batch plant then taken to job with mixer at agitate speed (4 RPM), then mixed on the job at 20, 40, 50, and 70 total revolutions at mixing speed (12 RPM). Tests were taken at various stages of mixing.

MIXING CONCRETE
UNIT II

TEST

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. (Terms and definitions are continued on the next page.)

______a. Black isometric mineral that is an oxide of iron

______b. Native hydrous ferric oxide of variable composition that is a major ore of iron

______c. Usually massive iron-black mineral composed of iron, titanium, and oxygen

______d. Mineral constituting an important iron ore and occurring in crystals or in a red earthy form

______e. Mineral that consists of an iron hydrogen oxide

______f. Iron containing phosphorous

______g. Barium sulfate occurring as a mineral

______h. Uncharged elementary particle that has a mass nearly equal to that of a proton

______i. Radiation quantum emitted spontaneously by a radioactive substance

______j. Rock composed of the finer kinds of volcanic disintegrations

______k. Refuse from melting of metals; the slag

______l. Volcanic glass full of cavities and very light in weight

______m. Finely-divided residue that results from the combustion of ground or powdered coal transported from the firebox through the boiler by flue gases

______n. Light, easily broken, siliceous material resembling chalk

1. Ilmenite
2. Limonite
3. Magnetite
4. Hematite
5. Goethite
6. Barite
7. Gamma ray
8. Scoria
9. Fly ash
10. Sintering
11. Vermiculite
12. Slump
13. A.S.T.M.
14. Economy
15. Ferrophosphorous
16. Neutron radiation
17. Tuff
18. Pumice
19. Diatomite
20. Calcining
21. Perlite

______o. To become a coherent mass by heating without melting

______p. To alter composition or physical state by heating

______q. Micaceous mineral that is a hydrous silicate derived usually from alteration of mica; when expanded by heat, forms a lightweight aggregate

______r. Volcanic glass that has a concentric shelly structure and, when expanded by heat, forms a lightweight aggregate

______s. Amount of each ingredient used in a concrete mixture

______t. Ease with which concrete can be placed and consolidated

______u. Minimizing the amount of cement required at the least cost and without sacrificing quality

______v. Consistency of concrete

______w. American Society for Testing and Materials

______x. Scrap pellets or discs produced from metal punch presses

______y. Concrete made from lightweight aggregate where lightness in weight and compressive strength of the concrete are of principal concern

______z. Concrete made from lightweight aggregate that has good fire resistance and insulation against heat and sound

_____aa. Concrete made from heavyweight aggregate to increase the unit weight but also decrease the size of the units required to absorb or slow down radiation

22. Ratio
23. Workability
24. Heavyweight concrete
25. Structural lightweight concrete
26. Steel shots and punchings
27. Insulating lightweight concrete

2. Name three achievements of correctly designed mix.

   a.

   b.

   c.

3. Name four qualities of hardened concrete.

   a.

   b.

   c.

   d.

4. Name four factors affecting quality of hardened concrete.

   a.

   b.

   c.

   d.

5. Select from the list below factors to consider before designing a mix. Place an "X" in the proper blanks.

   _____a. Slump

   _____b. Shape

   _____c. Required strength

   _____d. Type of truck used

   _____e. Exposure conditions

   _____f. Size

6. Name three factors that affect the economy of mix design.

   a.

   b.

   c.

7. Name four factors to consider before determining satisfactory mix proportions.

   a.

   b.

   c.

   d.

8. Discuss in a few words optimum mix proportions.

9. Select from the list below four factors influencing the selection of mix proportions. Circle the correct letters.

   a. Slump

   b. Cost

   c. Amount of air

   d. Strength

   e. Workability

   f. Type of finish

   g. Durability

10. Match the moisture allowances on the right to the types of aggregates. Place numbers in the correct blanks.

    ______a. Dry — 1. Four and one-half gallons

    ______b. Damp — 2. Five gallons

    ______c. Wet — 3. Six or seven gallons

    ______d. Very wet — 4. Five and one-half gallons

11. Discuss in a few words the difference between rich mix and lean mix.

12. Match the designed mixes on the right to descriptions of air-entrained or non-air-entrained concrete on left. Place the appropriate numbers in the blanks provided.

______a. Same material with an increase in air content

______b. Less air content

______c. More water and a little more fine aggregate

______d. Same material but with less air content

1. Rich mix, air-entrained

2. Rich mix, non-air-entrained

3. Lean mix, air-entrained

4. Lean mix, non-air entrained

13. Select from the list below the required mixing time of concrete. Circle the letter of the correct answer.

a. Three minutes for stationary mixes

b. One minute for stationary mixes

c. Fifteen seconds for stationary mixes

14. Select from the list below the allowable delivery and discharge time for concrete. Circle the letters of the correct answers.

a. Within two hours after the introduction of water

b. Before the drum has revolved three hundred times

c. Within one and one-half hours after the introduction of water

d. Before drum has revolved two hundred times

15. Name three special types of concrete.

a.

b.

c.

16. Select from the list below the approximate weight range of lightweight concrete. Place an "X" in the proper blank.

______a. Fifteen to ninety pounds per cubic yard

______b. Fifty to ninety pounds per square foot

______c. Fifteen to ninety pounds per cubic foot

17. Select from the list below the approximate weight range of heavyweight concrete. Place an "X" in the proper blank.

    ______a. Under 150 pounds per square foot

    ______b. Over 150 pounds per cubic foot

    ______c. 150 pounds per square yard

18. Match the groups of lightweight concrete on the right to the proper ingredients. Place the appropriate numbers in the blanks.

    ______a. Made with aggregates and expanded materials, such as perlite and vermiculite

    ______b. Made by incorporating in a cement paste or cement/sand ratio a uniform cellular structure of air voids

    ______c. Made with aggregates manufactured by expanding, calcining, or sintering materials

    1. Group I
    2. Group II
    3. Group III

19. Name four types of jobs where lightweight insulating concrete is used.

    a.

    b.

    c.

    d.

20. Name three jobs where structural lightweight concrete is used.

    a.

    b.

    c.

21. Discuss in a few words the uses of heavyweight concrete.

22. Select from the list below five aggregates used in heavyweight concrete. Place an "X" in the appropriate blanks.

_____a. Magnetite

_____b. Magnesium

_____c. Hematite

_____d. Perlite

_____e. Barite

_____f. Silicon

_____g. Goethite

_____h. Limonite

_____i. Aluminum punchings

23. Name three factors that determine the selection of aggregate for heavyweight concrete.

a.

b.

c.

24. Name two factors that determine the size of coarse aggregate.

a.

b.

25. Select from the list below rules that limit the size of aggregate used in concrete. Circle correct letters.

a. One-third the depth of nonreinforced slabs on grade

b. Four-fifths the dimension of nonreinforced members

c. Three-eighths the clear spacing between reinforcing bars or between bars and forms

d. One-fifth the dimension of nonreinforced members

e. Three-fourths the clear spacing between reinforcing bars or between bars and forms

MIXING CONCRETE
UNIT II

ANSWERS TO TEST

1.
   - a. 3
   - b. 2
   - c. 1
   - d. 4
   - e. 5
   - f. 15
   - g. 6
   - h. 16
   - i. 7
   - j. 17
   - k. 8
   - l. 18
   - m. 9
   - n. 19
   - o. 10
   - p. 20
   - q. 11
   - r. 21
   - s. 22
   - t. 23
   - u. 14
   - v. 12
   - w. 13
   - x. 26
   - y. 25
   - z. 27
   - aa. 24

2.
   - a. Required qualities of hardened concrete
   - b. Workability of fresh concrete
   - c. Economy

3.
   - a. Durability
   - b. Wear resistance
   - c. Strength
   - d. Water tightness

4.
   - a. Water/cement ratio
   - b. Aggregate
   - c. Entrained air
   - d. Curing

5. b, c, e, f

6.
   - a. Stiffest practical mixture
   - b. Largest aggregate practical
   - c. Optimum ratio of fine to coarse aggregate

7. a. Water/cement ratio
   b. Maximum size of aggregate
   c. Air content
   d. Range of slump
8. Discussion should include the following points.
   a. Small sample batches made with laboratory precision
   b. Job-size batches made during the course of normal concrete production
9. b, d, e, g
10. a. 3
    b. 4
    c. 2
    d. 1
11. Discussion should include the following points.
    a. Rich mix
       1) More cement and water
       2) Less coarse aggregate
    b. Lean mix
       1) Less cement and water
       2) More coarse aggregate
12. a. 3
    b. 1
    c. 2
    d. 4
13. b
14. b, c
15. a. Lightweight insulating concrete
    b. Structural lightweight concrete
    c. Heavyweight concrete

16. c

17. b

18. a. 1

    b. 3

    c. 2

19. a. Roofs

    b. Firewalls

    c. Floor fills

    d. Underground thermal conduit linings

20. a. Floors

    b. Structural members of high-rise buildings

    c. Many areas where regular concrete is used

21. Discussion should include the following points

    a. As a shielding material to protect men and equipment from harmful effects of x-rays, gamma rays, and neutron radiation

    b. On floors where hard wearing is needed

22. a, c, e, g, h

23. a. Physical properties

    b. Availability

    c. Cost

24. a. Size and shape of concrete members

    b. Amount and distribution of reinforcing steel

25. a, d, e

ADMIXTURES
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to state the purposes of admixtures and match the admixture to its proper function. He should be able to discuss how admixtures benefit concrete and the cement mason. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with admixtures to the correct definitions.
2. Match types of admixtures to their functions.
3. State two purposes for each admixture.
4. Discuss in a short paragraph the benefits of admixtures in concrete.
5. Discuss in a short paragraph how admixtures benefit the cement mason.

ADMIXTURES
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide each student with objective sheet.

  B. Provide each student with information sheets.

  C. Discuss terminal and specific objectives.

  D. Discuss information sheets.

  E. Contact a local manufacturer for information on and demonstration of admixtures.

  F. Contact Portland Cement Association for "Quality Concrete Slide Reference File," illustrating suitable visual aids in relation to admixtures.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheets

  C. Test

  D. Answers to test

II. References:

  A. Master Builders. *Admixtures for Improving Concrete and Mortar.* General Catalog, Section I. 1970.

B. *Colors for Concrete and Mortar.* Frank D. Davis Company, 1970.

C. Price, Walter H. *Admixtures for the Ready Mix Industry.* Ready Mixed Concrete. June, 1964.

D. *Annual Book of ASTM Standards: Concrete and Mineral Aggregates (Including Manual of Concrete Testing),* Part 10. Easton, Maryland: American Society for Testing and Materials, 1973.

E. Brady, George S. *Materials Handbook: An Encyclopedia for Purchasing Managers, Engineers, Executives, and Foremen.* New York: McGraw-Hill Book Company, 1971.

ADMIXTURES
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Admixture--Component developed to mix with concrete for specific purposes; added at batch plant

   B. Workability--Ease with which concrete can be mixed, placed, compacted, and finished

   C. Color pigment--Substance that when added to concrete brings out certain desired colors

   D. Agent--Chemically active ingredient which serves as a catalyst to bring out a desired reaction with concrete

   E. Siliceous--Containing silica or silicate material

   F. Aluminous--Containing alum or aluminum material

   G. Cementitious--Containing cement properties

   H. Calcium hydroxide--Fine air-float powder consisting of hydrated lime and magnesium

II. Types of admixtures and their functions

   A. Air-entraining--Agent that incorporates microscopic air bubbles into concrete

   B. Accelerator--Agent that speeds the set of concrete

   C. Retarder--Agent that delays setting time

   D. Waterproofer--Mixture of compounds that helps seal the concrete

   E. Color pigment--Agent used to achieve a desired color in concrete

   (NOTE: The pigments can either be mineral or synthetic.)

   F. Water reducer--Increases the fluidity of the concrete

   G. Pozzolan--Siliceous and aluminous material which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties

INFORMATION SHEET

III. Purposes of admixtures

A. Air-entraining

1. Improves workability of concrete

2. Improves resistance to freezing and thawing

3. Improves resistance to scaling due to de-icing chemicals

B. Accelerator

1. Speeds up setting time

2. Increases early strength

C. Retarder

1. Offsets adverse high temperature weather conditions

2. Slows down setting time

(NOTE: Using retarders in concrete supplies the mason with additional time to work and finish the concrete.)

D. Waterproofer

1. Increases strength

2. Helps prevent absorption of water

(NOTE: Waterproofers seal the outside of the concrete and allow the concrete to cure from within.)

E. Color pigment

1. Enhances appearance

2. Reduces glare from sun

3. Conveys information, such as highway safety markings and aisles and hazardous areas in industrial plants

F. Water reducer

1. Reduces the amount of mix water required

2. Increases workability without decreasing strength

INFORMATION SHEET

G. Pozzolan

  1. Increases workability but not necessarily finishability

  2. Lowers cost

  3. Reduces heat of hydration

IV. Benefits of admixtures in concrete

  A. Increase durability

  B. Improve resistance to effects from freezing and thawing

  C. Control setting time

  D. Increase strength

  E. Bring out beauty of concrete

V. Benefits of admixtures to the cement mason

  A. Produce a more workable concrete

  B. Provide mason with time variation in regard to finish work

ADMIXTURES
UNIT III

TEST

1. Match the terms on the right to the correct definitions.

_____a. Component developed to mix with concrete for specific purposes; added at batch plant

_____b. Ease with which concrete can be mixed, placed, compacted, and finished

_____c. Containing cement properties

_____d. Substance that when added to concrete brings out certain desired colors

_____e. Chemically active ingredient which serves as a catalyst to bring out a desired reaction with concrete

_____f. Containing alum or aluminum material

_____g. Containing silica or silicate material

_____h. Fine air-float powder consisting of hydrated lime and magnesium

1. Agent
2. Admixture
3. Color pigment
4. Workability
5. Cementitious
6. Siliceous
7. Calcium hydroxide
8. Aluminous

2. Match the type of admixture on the right to its proper function. Place the correct number in the blank.

_____a. Agent that speeds the set of concrete

_____b. Mixture of compounds that helps seal the concrete

_____c. Agent used to achieve a desired color in concrete

_____d. Agent that delays setting time

_____e. Agent that incorporates microscopic air bubbles into concrete

_____f. Increases the fluidity of the concrete

_____g. Siliceous and aluminous material which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties

1. Color pigment
2. Waterproofer
3. Retarder
4. Accelerator
5. Air-entraining
6. Pozzolan
7. Water reducer

3. State two purposes for each of the following admixtures.
    a. Retarder
        1)
        2)
    b. Accelerator
        1)
        2)
    c. Air-entraining
        1)
        2)
    d. Color pigment
        1)
        2)
    e. Waterproofer
        1)
        2)
    f. Water reducer
        1)
        2)
    g. Pozzolan
        1)
        2)
4. Discuss in a short paragraph the benefits of admixtures in concrete.

5. Discuss in a short paragraph how admixtures benefit the cement mason.

ADMIXTURES
UNIT III

ANSWERS TO TEST

1. a. 2
   - b. 4
   - c. 5
   - d. 3
   - e. 1
   - f. 8
   - g. 6
   - h. 7
2. a. 4
   - b. 2
   - c. 1
   - d. 3
   - e. 5
   - f. 7
   - g. 6
3. a. Retarder
      - 1) Offsets adverse high temperature weather conditions
      - 2) Slows down setting time
   - b. Accelerator
      - 1) Speeds up setting time
      - 2) Increases early strength

c. Air-entraining

(NOTE: Any two of the following are acceptable.)

1) Improves workability of concrete

2) Improves resistance to freezing and thawing

3) Improves resistance to scaling due to de-icing chemicals

d. Color pigment

(NOTE: Any two of the following are acceptable.)

1) Appearance

2) Reduces glare from sun

3) Conveys information, such as highway markings and aisles and hazardous areas in industrial plants

e. Waterproofer

1) Increases strength

2) Helps prevent absorption of water

f. Water reducer

1) Reduces the amount of mix water required

2) Increases workability without decreasing strength

g. Pozzolan

(NOTE: Any two of the following are acceptable.)

1) Increases workability but not necessarily finishability

2) Lowers cost

3) Reduces heat of hydration

4. Discussion should include the following points.

a. Increase durability

b. Improve resistance to effects from freezing and thawing

c. Control setting time

   d. Increase strength

   e. Bring out beauty of concrete

5. Discussion should include the following points.

   a. Produce a more workable concrete

   b. Provide mason with time variation in regard to finish work

SPECIFICATIONS AND TESTING
UNIT IV

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to discuss the purposes of specifications as they relate to the cement mason and to select factors included in specifications. He should be able to match the type of test to the purpose for each test and to demonstrate the ability to make a slump test and cylinder cast. He should be able to read and interpret a set of specifications. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with specifications and testing to the correct definitions.
2. Discuss in a short paragraph the purposes of specifications as related to the cement mason.
3. Select from a list factors included in a set of specifications pertaining to concrete.
4. Match the type of concrete test to the purpose for each test.
5. Demonstrate the ability to:
    a. Read and interpret a set of specifications pertaining to concrete.
    b. Make a slump test.
    c. Make a cylinder cast.
    d. Make a flexural test specimen.
    e. Make an air test using air indicator.
    f. Make an air test using volumetric method.

SPECIFICATIONS AND TESTING
UNIT IV

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information, job, and assignment sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Take field trip to local testing company or invite local testing company to come and demonstrate different tests.

   G. Demonstrate and discuss procedures outlined in the job sheets.

   H. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheet.

   D. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

   E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Types of Concrete Tests

      2. TM 2--Types of Concrete Tests (Continued)

    3. TM 3--Types of Concrete Tests (Continued)
    4. TM 4--Types of Concrete Tests (Continued)

D. Assignment Sheet #1--Read and Interpret a Set of Specifications

E. Answers to assignment sheet

F. Job sheets

    1. Job Sheet #1--Make a Slump Test
    2. Job Sheet #2--Make a Cylinder Cast
    3. Job Sheet #3--Make a Flexural Test Specimen
    4. Job Sheet #4--Make an Air Test Using Air Indicator
    5. Job Sheet #5--Make an Air Test Using Volumetric Method

G. Test

H. Answers to test

II. References:

A. Burke, Arthur E., J. Ralph Dalzell and Gilbert Townsend. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1950.

B. *Tips on Control Tests for Quality Concrete.* Portland Cement Association, 1965.

C. *Performance Data on Admixtures for Improving Concrete and Related Reference Data.* Cleveland: Master Builders, 1967.

D. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

E. *Annual Book of ASTM Standards, Part 10.* Easton, Maryland: American Society for Testing and Materials, 1973.

SPECIFICATIONS AND TESTING
UNIT IV

INFORMATION SHEET

I. Terms and definitions

- A. Factor--Item that pertains to accomplishing the finished product

  (NOTE: We refer to factors as items such as dimensions, tolerances, colors, and finishes.)

- B. Slump--Measure of the consistency of fresh concrete
- C. Slump test--Determines the slump or consistency of fresh concrete
- D. Cylinder test--Determines the adequacy of mix proportions for strength
- E. Air test--Determines the amount of air in concrete
- F. Dimension--Specific measurement
- G. Tolerance--Permitted variation range from a specified dimension
- H. Working drawings--Directions for workmen on the job site
- I. Flexural test--Test used to check the adequacy of mix proportions for strength in bending

  (NOTE: The test specimen is usually a 6x6x30 inch beam.)

- J. Impact test--Test used to check the strength of cured concrete

  (NOTE: This test is a result of applying an impact to concrete, and the impact is recorded by a meter.)

- K. Core test--Test used to register the compressive strength of cured concrete

  (NOTE: This test is applied by coring a cylinder from cured concrete.)

- L. American Standards for Testing and Materials (ASTM)--Organization responsible for establishing standards for testing and materials
- M. Cement dispersion agent--Admixture used to reduce water content, increase efficiency of cement hydration, and control setting time

INFORMATION SHEET

N. Grout--Mixture of sand and cement used to level base plates and equipment bases

(NOTE: There are also commercial types of grouting materials that pertain to concrete.)

O. Vapor barrier--Covering used to seal out moisture and to hold moisture in concrete for better curing

II. Purposes of specifications

A. Provide instructions to cement mason

B. Explain drawings

C. Describe materials and equipment

(NOTE: Materials and equipment are related to quality and types.)

D. Are part of the construction contract, along with drawings

III. Factors included in a set of specifications

A. Sizes

B. Types and quality of building materials

C. Concrete finishes

D. Method of construction

E. Slump of concrete

F. Concrete test

G. Types of concrete

H. Tolerances

(NOTE: The above factors are parts of a set of specifications that apply to the cement mason.)

IV. Types of concrete tests (Transparencies 1-4)

A. Slump--Determines consistency of fresh concrete

B. Cylinder or compression--Checks adequacy of mix proportions for compressive strength

INFORMATION SHEET

C. Flexural--Checks adequacy of mix proportions for flexural strength

D. Air--Determines the amount of air in concrete

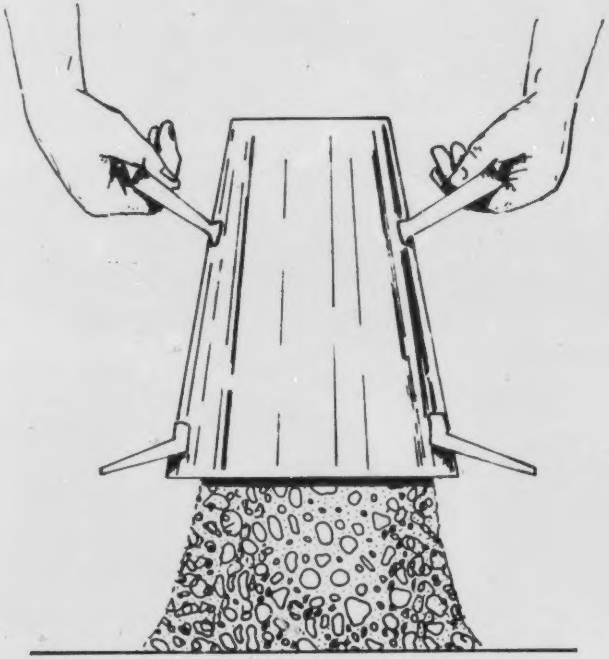
E. Impact--Determines approximate strength of hardened concrete

F. Core--Determines strength of hardened concrete

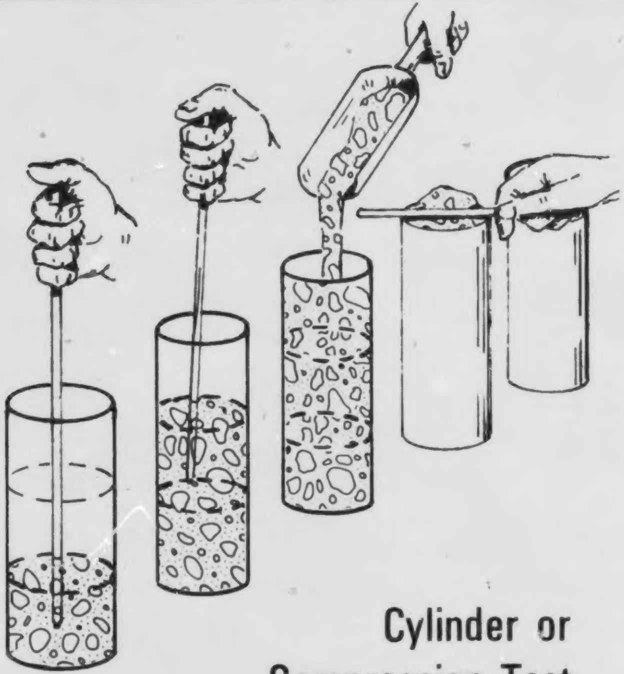
G. Temperature--Checks temperature of fresh concrete

H. Ball penetration--Determines consistency of fresh concrete

Types of Concrete Tests



Slump Test



Cylinder or
Compression Test

Types of Concrete Tests

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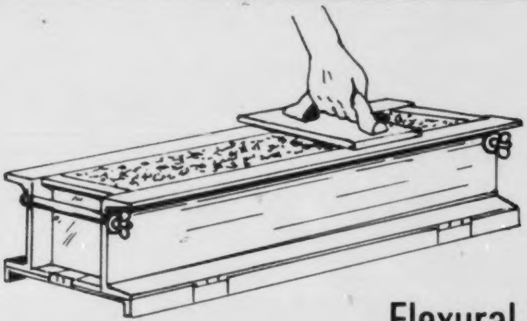
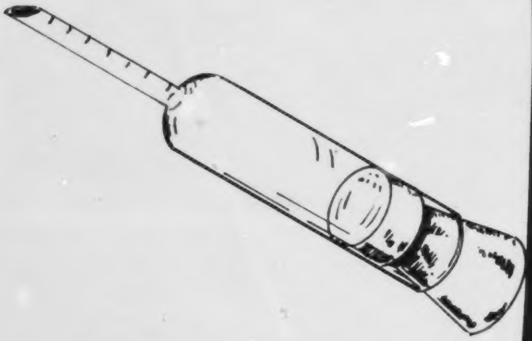
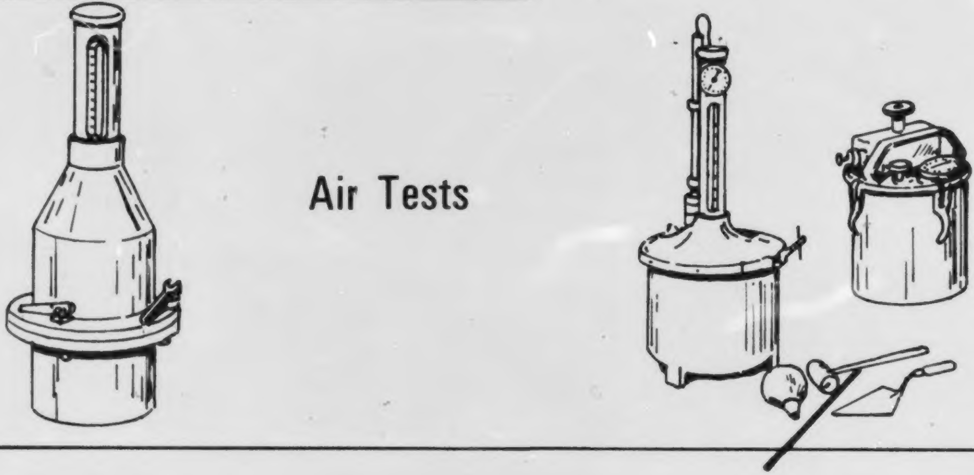


Flexural Test





Air Tests

Types of Concrete Tests

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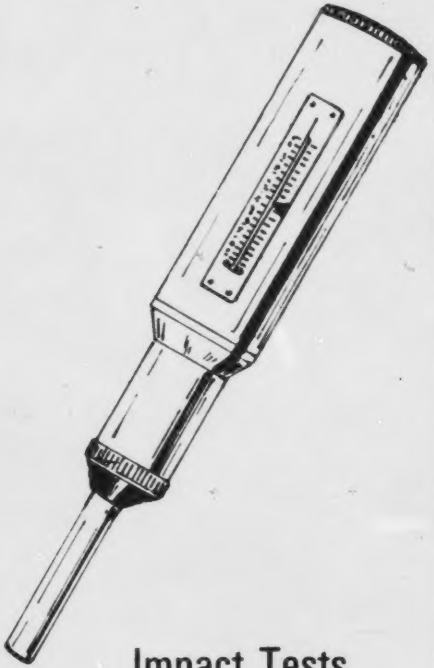
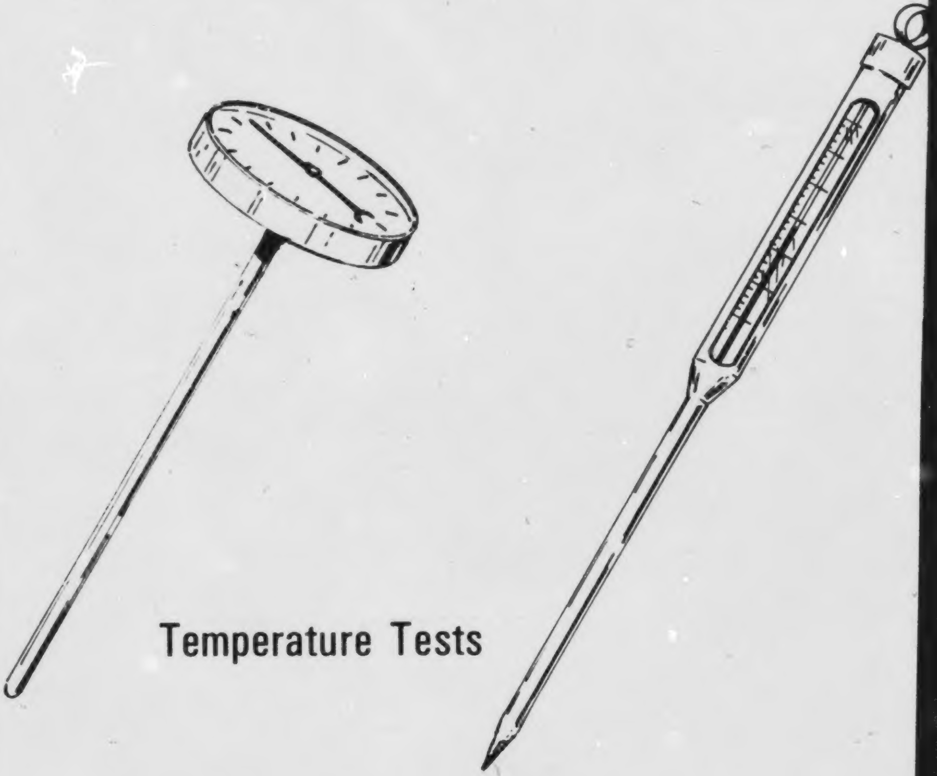


Impact Tests



Temperature Tests

Types of Concrete Tests

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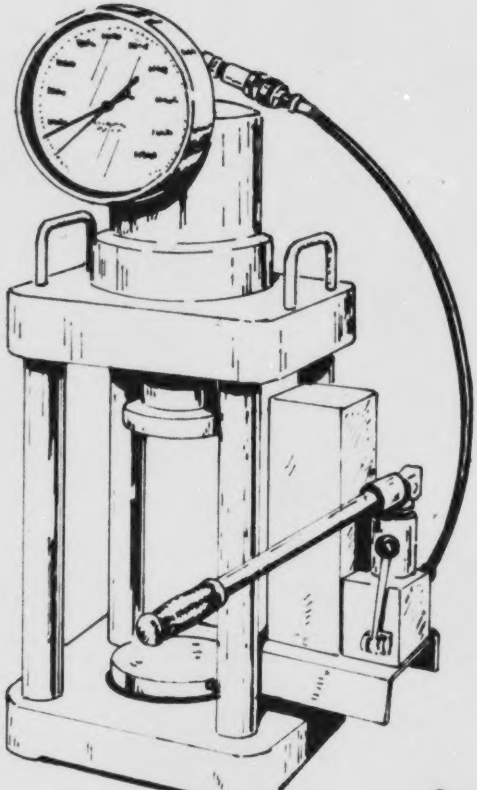
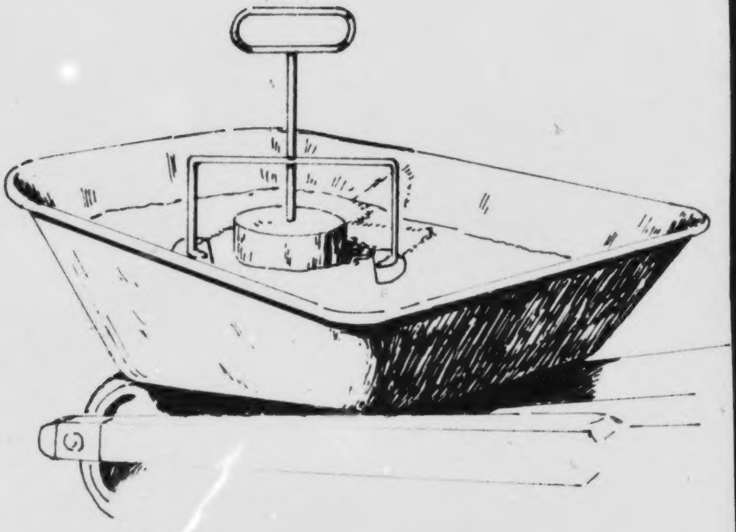


Core Test

Ball Penetration Test



SPECIFICATIONS AND TESTING
UNIT IV

ASSIGNMENT SHEET #1--READ AND INTERPRET A SET OF SPECIFICATIONS

Using the set of specifications provided on the following pages, answer the questions below.

1. List the three cement dispersion agents.

   a.

   b.

   c.

2. Name the two types of grouts.

   a.

   b.

3. What is to be used as a vapor barrier?

4. What slump is specified for slabs on the ground?

5. What amount of air is specified in concrete for sidewalks?

6. How many test cylinders shall be made for more than four cubic yards used on sidewalks?

7. What is the brand name of the curing compound?

8. List three types of concrete specified for this structure.

   a.

   b.

   c.

9. What is the tolerence specified for a finished slab?

10. What type of finish is specified for slabs?

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CONCRETE WORK

3A-1.

1. GENERAL NOTES:

(A) See drawings, schedules, and details for type and location of concrete and cement work required.

(B) Inserts and pipe sleeves for mechanical and electrical work are included under mechanical divisions of the specifications.

(C) Anchor bolts for wood, steel, etc. are included under their respective headings.

2. MATERIALS:

(A) PORTLAND CEMENT: ASTM C150-60 and ASTM T175-60; use Type I or IA for all concrete work.

(B) COARSE AGGREGATE: Hard, durable, uncoated crushed stone or gravel conforming to ASTM C33 latest specification.

(C) SAND: Clean, hard, durable, uncoated grains free from salt, lignite, loam, and clay, to conform to ASTM C33 latest edition.

(D) CEMENT DISPERSION AGENT: Shall be equal to "Pozzolith," "Plastiment," or "Placewell" used in accordance with manufacturer's recommendations. Use in all concrete except slabs on grade.

(E) MIXING WATER: Clean and free from oil, acid, and injurious amounts of vegetable matter, alkalies, and other salts.

(F) REINFORCING STEEL: Shall conform to ASTM STANDARD A615, Grade 60. Metal shall be clean and free from excessive rust, scale, or coatings that will reduce bond.

(G) STEEL FABRIC REINFORCING: Shall conform to ASTM A185-61T. Steel wire spot-welded at intersections and of size indicated. Steel fabric shall be lapped not less than 2 inches along edges and not less than one full mesh at ends where laps are required. Where size is not noted, use 66-1010 mesh.

(H) METAL ACCESSORIES: Include all spacers, chairs, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place.

(I) EXPANSION JOINT FILLER: Asphalt impregnated fiberboard conforming to ASTM D1751-65. Joint material shall be full thickness of slab or joint and, unless otherwise indicated, 1/2 inch thick.

(J) GROUT: For bearing plates and column base plates shall be Sonneborn Co. "Ferrolith" or Embeco non-shrink grout.

(K) VAPOR BARRIER: Under all concrete slabs on grade to be 6 mil polyethylene film, placed over leveled subgrade immediately before pouring concrete. Lap all edges a minimum of 6 inches.

3. FORMS: Where concrete will be exposed, use moisture-resistant plywood forms. Sheets shall be as large as possible with smooth even edges and installed with close joints. Joint marks and fins shall be smoothed off and surfaces left smooth, dense, and free from honeycombing, prominent grain marking, and bulges or depressions.

4. CONSTRUCTION OF FORMS: Construct forms to slopes, lines, and dimensions shown, plumb and straight and sufficiently tight to prevent leakage; securely brace and shore forms to prevent displacement and to safely support construction loads. Provide access openings to clean and inspect forms and reinforcing prior to depositing concrete. Do not coat forms with material that will stain or cause injury to expose concrete surfaces. Construct forms for beams, girders, and lintels so that sides may be removed without disturbing bottom of form or its support.

5. PLACING REINFORCEMENT: Place reinforcement accurately in position shown; securely fasten and support to prevent displacement before or during pouring. Allow time for inspection before placing concrete.

6. INSERTS AND FASTENING DEVICES FOR OTHER WORK:

(A) Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, stair nosings, dowels, thimbles, slots, nailing strips, blocking, grounds, and other fastening devices required for attachment of other work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete beams, joists, or columns except upon approval of the architect.

(B) Where concrete walls, columns, or beams more than 16 inches in height are veneered with masonry, build metal anchor slots into concrete; space inserts not over 3 feet apart horizontally.

7. CONCRETE:

(A) The working stresses from the design of this structure are based on the concrete having minimum compressive strength at the end of a 28-day period of 3,000#, unless otherwise noted. Use minimum of 5 1/4 bags of cement per cu. yard. Only enough water to be used so as to produce a concrete within the following consistency range in slump. Use the lowest slump, compatible with proper placing: foundation walls and footings 2" to 5", slabs, beams, and columns 3" to 5", slabs on ground and pavement 2" to 4". When a cement dispersion agent is used, reduce the amount of water to stay within the slump specified.

(B) Concrete for walks and platforms shall contain an air entraining agent conforming to Specifications for Air-Entraining Admixtures for Concrete (ASTM C260). Amount of air shall be 5% minimum and 7% maximum.

(C) No salt, chemical, dust, or other foreign material shall be added to the concrete mixture to prevent freezing or for any other purpose except cement dispersion agent previously specified.

(D) The architect shall have the right to make any change in proportion or materials that may be necessary or desirable. Proper adjustments of compensation will be made in accordance with the provisions of the contract.

8. MEASURING: The method of measuring water and aggregate shall be such as to secure specified proportion in each batch and in manner that proportion of water to cement can be closely controlled and easily checked at any time.

9. MIXING CONCRETE: Ready-mixed concrete shall be delivered to the site according to standards set forth by ASTM C94. Contractor shall see that a sufficient number of mixers are provided to rapidly carry on the work. No retempering or partially hardened concrete will be permitted. Concrete shall be mixed no longer than 1 1/2 hours or 300 revolutions before discharge.

10. CONCRETE CONTROL TESTS:

(A) Two standard 6" x 12" cylinders shall be made for each pour of more than 10 cubic yards or for each fifty cubic yards of concrete, except that for slabs or walks on grade two cylinders shall be made for each pour of more than 4 cubic yards, or for each 20 cubic yards of concrete. One cylinder shall be crushed at 7 days, and the other at 28 days.

(B) The contractor shall employ and pay for the services of a testing laboratory to test the compression cylinders and check the materials to determine compliance with specification requirements. All tests shall be made in accordance with ASTM standards. The contractor shall make and deliver the cylinders to the laboratory for testing and shall properly identify the locations of the pours to which the cylinder refer. Submit copies in triplicate of laboratory test reports to the architect during progress of the construction.

(C) In all cases where the average strength of the laboratory control cylinder shown by these tests for any portion of the structure falls below the minimum ultimate compressive strength called for on the plans, the architect shall have the right to order a change in the mix or in the water content for the remaining portion of the structure. In cases where the average strength of the cylinders cured on the job falls below the required strength, the architect shall have the right to require conditions of temperature and moisture necessary to secure the required strength and may require load tests to be made on the portions of the building so affected.

11. PLACING CONCRETE:

(A) Place no concrete until foundations, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, waterproofing, and other work required to be built into concrete has been inspected and approved by the architect. Before pouring footings or foundations, see that bottoms of excavations are undisturbed earth, properly leveled off.

(B) All concrete shall be mechanically vibrated to prevent honeycombing, using internal vibrators of proper size. Vibration shall be concentrated in vertically consolidating the concrete. Do not use vibration to move concrete laterally.

(C) No work shall be done at temperatures below 30 degrees unless weathertight enclosures and artificial heat are used.

12. FINISH OF ROUGH STRUCTURAL SLABS: Slab surfaces, except where integral cement finish is required, shall be thoroughly raked or wire broomed to provide bond for other finishes.

13. REMOVAL OF FORMS: Remove forms only with consent of the architect, without damage to concrete and in manner to insure complete safety of the structure. Leave shoring in place until concrete member will safely support its weight and the loads upon it.

14. PATCHING: Directly after forms have been removed, all exposed tie wires and stapled ends shall be removed from concrete surfaces to be exposed; cut ties flush with finished surfaces of all other concrete and fill honeycombing surfaces, stone pockets, and other irregularities with cement mortar, rubbing same to uniform surface.

15. ARCHITECTURAL CONCRETE: Exposed concrete surfaces shall be rubbed to a smooth and uniform surface with cement mortar immediately upon removing forms.

16. PROTECTION AND CURING:

(A) Protect concrete against frost and rapid drying and keep moist for at least 6 days after placing. Concrete from which forms are removed within 6 days after pouring and cement finishes shall be sprayed during the curing period as frequently as drying conditions may require and shall be protected by suitable temporary coverings.

(B) Floors shall be sprayed with "Demicon Cure-Hard" solution as per manufacturer's recommendations. Solution shall be tinted to make coverage visible. Floors may be cured by covering with a plastic film of at least 3 mil thickness.

17. GRAVEL OR CRUSHED ROCK: Shall be 4" thick, placed under all slabs on grade except walks. Well tamped to firm even surface. Gravel to be C gravel. Crushed rock to be minimum 3/4 inch.

18. FLOOR SLABS:

(A) In general concrete interior floor slabs on earth shall have integral finish, 66-1010 mesh reinforcing, and be 4 inches thick unless otherwise noted.

(B) Over steel centering to be 3 inches thick unless otherwise noted. To have 66-1010 mesh. Note details of slab over Cofar centering.

(C) Where floor slabs are to remain exposed, with no finish applied, take special care to protect slabs from staining, chipping, and abrasion.

19. CEMENT FINISH: After concrete slab has been properly struck off and darbied or bullfloated and when water sheen has disappeared and/or mix has sufficiently stiffened, begin floating operation. Both power and hand troweling shall be required. Continue troweling until surface is dense, smooth, and free of all blemishes. Final hand troweling shall be used to remove imperfections left by machine troweling and to bring surface to a dense, polished finish. Continue till trowel passing over surface causes ringing sound. No spreading of cement over slab to absorb moisture will be allowed. Finished slab is to vary no more than 1/8 inch when tested with a ten foot long straight edge. If variations greater than this exist, the architect may direct the contractor to grind the floor to bring the surface within the requirements. Patching of low spots will not be permitted. Slabs shall be leveled with the use of pipe screeds or "wet pads" leveled with an instrument.

20. PLATFORM: Shall have 66-1010 mesh reinforcing and shall be jointed as shown. Shall have aluminum floated integral cement finish, exposed vertical surfaces shall be formed with plywood for a smooth finish. To be 4" thick, and have a pitch of 1/4" to 1'-0" unless otherwise noted. Finish edges with edging tools.

21. UNIT PRICES: This contractor shall state in his bid to the general contractor the unit prices as listed below. These prices shall be used as a basis for adjusting the contract price for extras or credits:

(A) Price per cubic yard for additional concrete in place $__________
(B) Price per square foot for additional form work $__________
(C) Price per pound of additional reinforcing steel in place $__________

22. SHOP DRAWINGS: Reinforcing steel placing drawings and bar lists shall be prepared in accordance with ACI Standards by the structural engineer, Bergmeir, Siebold & Sydow, Inc., Crestwood Bank Building, 9705 Highway 66, St. Louis, Mo., 63126. The cost of this work shall be included in the contract price based upon standard published rates and estimated reinforcing bar tonnage.

GYPSUM ROOF DECKS

1. SCOPE:

The contractor shall furnish all labor, material, and equipment to complete the installation of the poured gypsum concrete roof decks, together with cants, curbs, and drainage fills as shown and specified. Approved shop drawings are required before work proceeds. Provide temporary walkways as necessary to handle materials.

2. MATERIALS:

(A) Subpurlins - steel subpurlins shall be special section bulb tees, of proper weight and section to support the required dead and live loads. They shall be shop painted with one coat of approved paint.

(B) Formboards shall be:

1. 3/4" Fiberglass formboard in lengths equal to main purlin spacings. Where end joints do not occur on main purlins, painted sheet metal tees are required to support end joints.

(C) Reinforcing mesh shall be:

1. Welded galvanized wire mesh equivalent to No. 12 gauge longitudinal wires spaced 4" on centers and No. 14 gauge transverse wire spaced not over 8" on centers; or

2. An approved equivalent type mesh having an effective cross sectional area of not less than 0.026 sq. in. per foot of slab width; or

3. A galvanized wire reinforcement having a minimum tensile strength of 70,000 psi--2" hexagonal mesh of No. 19 gauge and No. 16 gauge wires woven longitudinally every 3" across face of the mesh.

(D) Gypsum concrete shall be U.S. Gypsum's Thermofill. Only clean water shall be added on the job.

3. INSTALLATION:

(A) Subpurlins shall be placed to fit formboard widths and welded to each main purlin using a fillet weld (1/2" minimum) placed on alternate sides of subpurlins.

(B) Formboards shall be placed on subpurlin flanges with all end or cross joints supported by main purlins or special cross-tees. Formboard shall be cut to fit neatly at walls, curbs, and openings as required.

(C) Reinforcing mesh shall be laid with the No. 12 gauge wire at right angles to the subpurlins. Lap ends of mesh not less than 6". Sides of mesh shall not be lapped. Cut mesh to fit at walls, curbs, and openings and carry mesh into all areas where gypsum concrete is to be poured.

(D) Gypsum concrete shall be mixed only with clean water at the job and poured in place over the forms and reinforcing to an average thickness of not less than 2" (2 1/4" over asbestos-cement formboards). Screed all surfaces to a smooth even plane ready to receive roof covering. Pour cants, curbs, and drainage fills as shown or required. After the slab has been poured, roof shall be left free and clean for other trades.

SPECIFICATIONS AND TESTING
UNIT IV

ANSWERS TO ASSIGNMENT SHEET

1. a. Pozzolith
   b. Plastiment
   c. Placewell
2. a. Ferrolith
   b. Embeco
3. 6 mil polyethylene film
4. 2" to 4"
5. 5% to 7%
6. Two
7. Demicon Cure-Hard
8. a. Type I
   b. Type IA
   c. U.S. Gypsum's Thermofill
9. 1/8" in 10 feet
10. Hand trowel polished finish

SPECIFICATIONS AND TESTING
UNIT IV

JOB SHEET #1--MAKE A SLUMP TEST

I. Tools and materials

   A. Wheelbarrow

   B. Slump cone mold

   C. Bullet-nosed steel rod (smooth), 5/8" by 24"

   D. Scoop or trowel

   E. Rule

   F. Concrete

   G. Water in container

II. Procedure

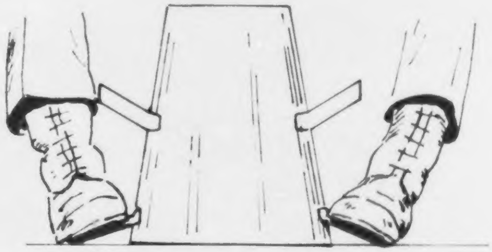
   A. Collect concrete in wheelbarrow

   B. Dampen slump cone mold with water

   C. Place slump cone mold on firm, level, clean, non-absorbent surface

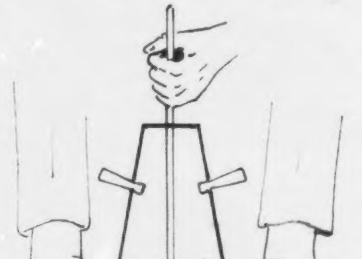
   D. Stand on the foot pieces of cone mold to hold it firmly in place (Figure 1)

FIGURE 1



   E. Fill 1/3 of cone mold with concrete (Figure 2)

FIGURE 2



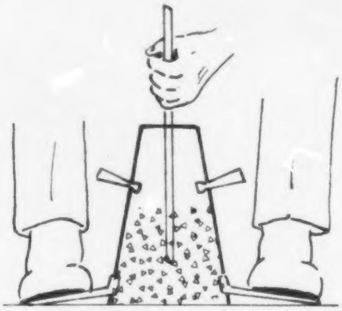
JOB SHEET #1

F. Rod with up and down motion twenty-five times using steel rod

(NOTE: Always distribute rodding strokes evenly by starting at outer edge and moving in a spiral toward center.)

G. Fill 2/3 of cone mold with concrete (Figure 3)

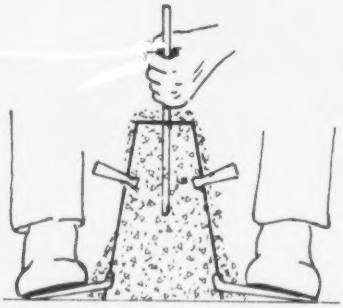
FIGURE 3



H. Rod twenty-five times, barely penetrating into first layer

I. Fill cone mold to overflowing with concrete (Figure 4)

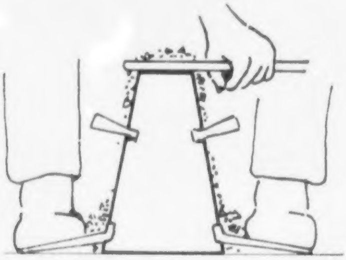
FIGURE 4



J. Again rod twenty-five times, taking same precautions about depth and distribution of strokes

K. Level top of cone with steel rod so that cone mold is level full (Figure 5)

FIGURE 5



JOB SHEET #1

L. Clean excess concrete away from base of cone mold

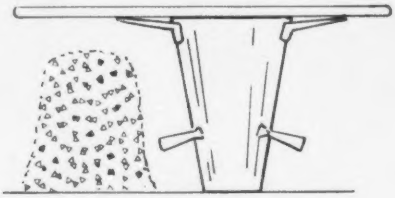
M. Immediately raise cone mold, taking only five to ten seconds to perform this operation

(CAUTION: Perform this operation with a steady upward lift. Do not shake mold in any way or disturb the sample.)

N. Place cone mold next to sample upside down, taking caution not to disturb it

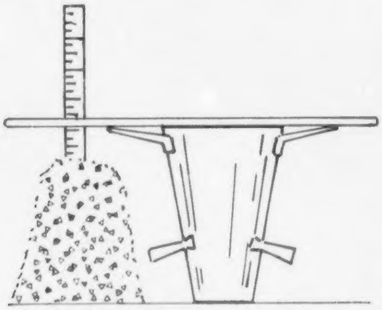
O. Place steel rod horizontally across mold so that it extends over the sample (Figure 6)

FIGURE 6



P. Measure distance from bottom of steel rod to the point of the original center of sample (Figure 7)

FIGURE 7



Q. This measurement, to the nearest 1/4", is the slump of the concrete

SPECIFICATIONS AND TESTING
UNIT IV

JOB SHEET #2--MAKE A CYLINDER CAST

I. Tools and materials

   A. Wheelbarrow

   B. Molds selected by instructor

   C. Bullet-nosed steel rod (smooth), 5/8" by 24"

   D. Scoop or trowel

   E. Concrete

   F. Shovel

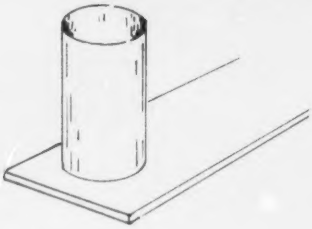
II. Procedure

   A. Take concrete sample from three parts of load in wheelbarrow

   B. Remix concrete sample in wheelbarrow with shovel

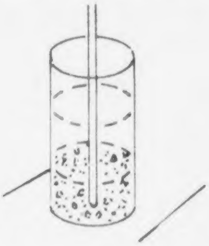
   C. Place cylinder mold on firm, level surface (Figure 1)

FIGURE 1



   D. Fill 1/3 of cylinder mold with concrete (Figure 2)

FIGURE 2



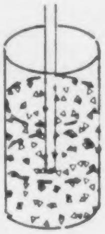
   E. Rod with up and down motion twenty-five times using the steel rod

   (NOTE: Always distribute rodding strokes evenly by starting at outer edge and moving in a spiral toward center.)

JOB SHEET #2

F. Fill 2/3 of cylinder mold with concrete (Figure 3)

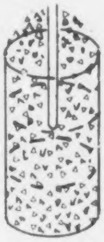
FIGURE 3



G. Rod twenty-five times, barely penetrating into first layer

H. Fill cylinder mold to overflowing with concrete (Figure 4)

FIGURE 4

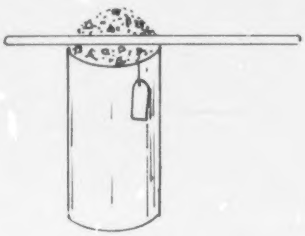


I. Again rod twenty-five times, taking same precautions about depth and distribution of strokes

J. Level top of mold with steel rod so that it is level full (Figure 5)

K. Tag cylinder

FIGURE 5



L. Clean excess concrete from around cylinder mold

M. Cover top of mold to prevent loss of moisture

N. Do not move mold for at least twenty-four hours

(CAUTION: Be careful during handling since it is necessary that molds do not suffer any damage.)

(NOTE: Cylinders should be cast in a protected area where temperatures will not exceed 80°F (27°C) or fall below 60°F (16°C). After twenty four hours, cylinder should be stored under conditions that maintain 60°-80°F (16°-27°C) and tops should be covered to prevent loss of moisture. Specimens can also be sent to a laboratory for similar standard curing.)

SPECIFICATIONS AND TESTING
UNIT IV

JOB SHEET #3--MAKE A FLEXURAL TEST SPECIMEN

I. Tools and materials

   A. Wheelbarrow

   B. Beam mold - 6" x 6" x 20"

   (NOTE: The standard beam shall be 6" x 6". The length shall be at least two inches greater than three times the depth as tested.)

   C. Bullet-nosed steel rod (smooth), 5/8" by 24"

   D. Scoop or trowel

   E. Wood float

   F. Shovel

   G. Concrete

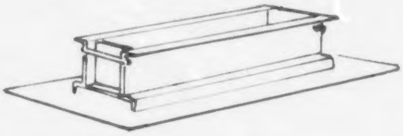
II. Procedure

   A. Take concrete sample from three parts of load in wheelbarrow

   B. Remix concrete sample in wheelbarrow with shovel

   C. Place beam mold on level surface (Figure 1)

FIGURE 1



   D. Fill one-third with concrete

   E. Rod with up and down motion thirty times using the steel rod and rod complete depth of concrete

   (NOTE: The number of roddings per layer required for beams is one for each two inches top surface area of the specimen. Always distribute rodding strokes uniformly over the cross section of the mold.)

   F. Spade sides and ends of mold with trowel after each layer

   G. Fill two-thirds of mold with concrete

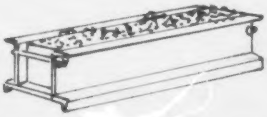
   H. Rod thirty times, allowing the rod to penetrate about 1/2 inch into underlying layer

   (NOTE: When the depth of the layer is less than four inches, allow the rod to penetrate about 1/2 inch into underlying layer.)

JOB SHEET #3

I. Fill mold to overflowing with concrete (Figure 2)

FIGURE 2

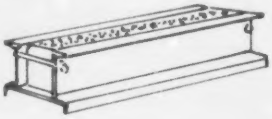


J. Again rod thirty times, taking same precautions about depth and distribution of stroke

K. Level top of mold with float or trowel as required (Figure 3)

(NOTE: Perform all finishing with minimum manipulation necessary to produce a flat, even surface level with the rim or edge of mold.)

FIGURE 3



L. Tag specimen

M. Clean excess concrete from around beam mold

N. Cover top of mold to prevent loss of moisture

O. Do not move mold for at least twenty-four hours

(CAUTION: Be careful during handling since it is necessary that molds do not suffer any damage.)

(NOTE: Cylinders should be cast in a protected area where temperatures will not exceed 80°F (27°C) or fall below 60°F (16°C). After twenty-four hours, cylinders should be stored under conditions that maintain 60°-80°F (16°-27°C) and tops should be covered to prevent loss of moisture. Specimens can also be sent to a laboratory for similar standard curing.)

SPECIFICATIONS AND TESTING
UNIT IV

JOB SHEET #4--MAKE AN AIR TEST USING AIR INDICATOR

I. Tools and materials

  A. Trowel

  B. Air indicator

  C. Concrete

  D. Alcohol

II. Procedure

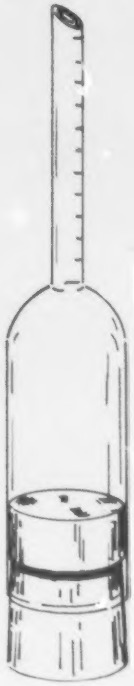
  A. Fill small container with a sample of mortar from fresh concrete

  B. Fill the tube with alcohol

  C. Stop open end with finger

  D. Shake tube to remove air from mortar

  E. Using calibration chart, determine approximate air content from drop in level of alcohol



Air Indicator

SPECIFICATIONS AND TESTING
UNIT IV

JOB SHEET #5--MAKE AN AIR TEST USING VOLUMETRIC METHOD

I. Tools and materials

  A. Wheelbarrow

  B. Shovel

  C. Air meter

  D. Funnel

  E. Tamping rod, bullet-nosed steel rod (smooth), 5/8" x 12"

  F. Measuring cup--Capacity equal to 1.03 ± 0.04 percent of the volume of the bowl of the air meter

  G. Strike-off bar, 1/8" x 3/4" x 12"

  H. Syringe--Small rubber bulb syringe with capacity at least that of the measuring cup

  I. Pouring vessel, metal or glass, 1 quart capacity

  J. Margin trowel

  K. Small scoop

  L. Isopropyl alcohol

JOB SHEET #5

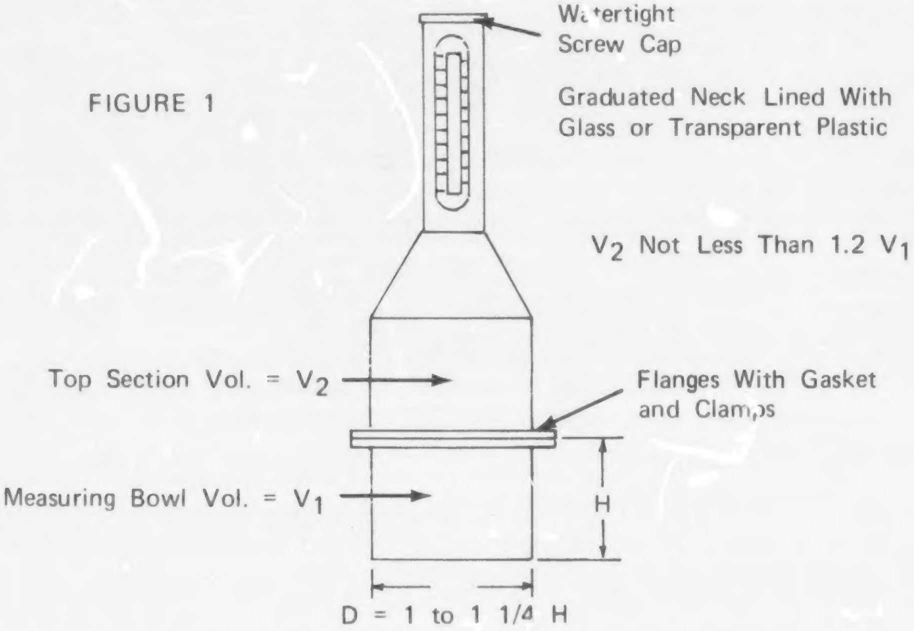
II. Procedure

A. Take concrete sample from three parts of load in wheelbarrow

B. Remix concrete sample in wheelbarrow with shovel

C. Place air meter on level surface (Figure 1)

FIGURE 1


Watertight Screw Cap
Graduated Neck Lined With Glass or Transparent Plastic
V_2 Not Less Than 1.2 V_1
Top Section Vol. = V_2
Flanges With Gasket and Clamps
Measuring Bowl Vol. = V_1
H
D = 1 to 1 1/4 H

D. Fill one-third of bowl with concrete

E. Rod with up and down motion twenty-five times using steel rod and rod complete depth of concrete

(NOTE: Always distribute rodding strokes evenly by starting at outer edge and moving in a spiral toward center.)

F. Using steel rod, tap sides of bowl ten to fifteen times

G. Fill two-thirds of bowl with concrete

H. Rod twenty-five times allowing rod to penetrate about one-half inch into underlying layer

(NOTE: When depth of layer is less than four inches, allow the rod to penetrate about one-half inch into underlying layer.)

JOB SHEET #5

I. Using steel rod, tap sides of bowl ten to fifteen times

J. Fill mold taking caution not to overflow

K. Again rod twenty-five times, taking same precautions about depth and distribution of strokes

L. Tap sides of bowl ten to fifteen times

M. After placement of third layer, strike off excess with strike-off bar until surface is flush with top of bowl

N. Wipe flange of bowl clean

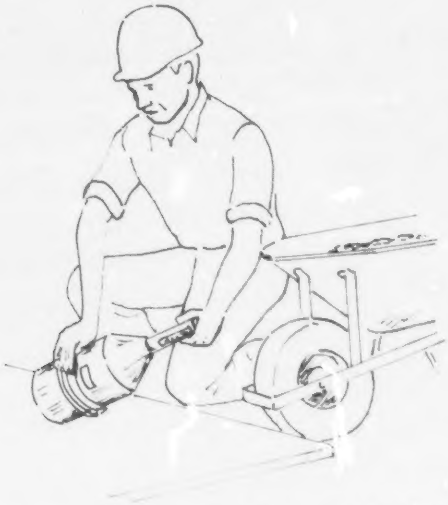
O. Clamp top section into position on bowl; insert funnel and add water until it appears in neck

P. Remove funnel and adjust water level, using rubber syringe, until bottom of the meniscus is level with the zero mark

Q. Attach and tighten the screw cap

R. Invert and agitate the unit until concrete settles free from the base; then, with neck elevated, roll and rock unit until air appears to have been removed from concrete (Figure 2)

FIGURE 2



S. Set apparatus upright, jar lightly, and allow it to stand until air rises to top; repeat operation until no further drop in water column is observed

T. When all air has been removed from concrete and allowed to rise to the top of apparatus, remove screw cap

JOB SHEET #5

U. Add, in one cup increments using syringe, sufficient alcohol to dispel the foamy mass on the surface of the water

V. Make direct reading of liquid in the neck, reading to the bottom of the meniscus and estimating to the nearest 0.1 percent

W. Calculate air content percent in the measuring bowl in percent by adding to the reading from Step V the amount of alcohol used in accordance with Step U.

SPECIFICATIONS AND TESTING
UNIT IV

TEST

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Item that pertains to accomplishing the finished product

_____b. Organization responsible for establishing standards for testing and materials

_____c. Measure of the consistency of fresh concrete

_____d. Test used to register the compressive strength of cured concrete

_____e. Specific measurement

_____f. Test used to check the strength of cured concrete

_____g. Permitted variation range from a specified dimension

_____h. Test used to check the adequacy of mix proportions for strength in bending

_____i. Directions for workmen on the job site

_____j. Determines the adequacy of mix proportions for strength

_____k. Determines the amount of air in concrete

_____l. Determines the slump or consistency of fresh concrete

_____m. Admixture used to reduce water content, increase efficiency of cement hydration, and control setting time

_____n. Mixture of sand and cement used to level base plates and equipment bases

_____o. Covering used to seal out moisture and to hold moisture in concrete for better curing

1. Working drawings
2. Tolerance
3. Dimension
4. Slump
5. Factor
6. Core test
7. Impact test
8. Flexural test
9. American Standards for Testing and Materials (ASTM)
10. Slump test
11. Air test
12. Cylinder test
13. Grout
14. Vapor barrier
15. Cement dispersion agent

2. Discuss in a short paragraph the purposes of specifications as related to the cement mason.

3. Select from the list below factors included in a set of specifications. Circle the letters of the correct answers.

   a. Location of job office

   b. Slump of concrete

   c. Types of concrete

   d. Concrete finishes

   e. Job superintendent's name

   f. Tolerances

   g. Types of machinery used

   h. Number of concrete trucks

   i. Sizes

   j. Concrete test

4. Match the types of concrete tests on the right to the purposes for each test by placing the correct number or numbers in the blank. A blank may have more than one answer.

______a. Determines the amount of air in concrete

______b. Determines strength of hardened concrete

______c. Determines consistency of fresh concrete

______d. Checks temperature of fresh concrete

______e. Checks adequacy of mix proportions for compressive strength

______f. Checks adequacy of mix proportions for flexural strength

1. Flexural
2. Temperature
3. Slump
4. Cylinder or compression
5. Air
6. Impact
7. Ball penetration
8. Core

5. Demonstrate the ability to:

a. Read and interpret a set of specifications pertaining to concrete.

b. Make a slump test.

c. Make a cylinder cast.

d. Make a flexural test specimen.

e. Make an air test using air indicator.

f. Make an air test using volumetric method.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SPECIFICATIONS AND TESTING
UNIT IV

ANSWERS TO TEST

1.
   - a. 5
   - b. 9
   - c. 4
   - d. 6
   - e. 3
   - f. 7
   - g. 2
   - h. 8
   - i. 1
   - j. 12
   - k. 11
   - l. 10
   - m. 15
   - n. 13
   - o. 14
2. Discussion should include:
   - a. Provide instructions to cement mason
   - b. Explain drawings
   - c. Describe materials and equipment
   - d. Are part of the construction contract, along with drawings
3. b, c, d, f, i, j
4.
   - a. 5
   - b. 6, 8
   - c. 3, 7
   - d. 2
   - e. 4
   - f. 1
5. Performance skills evaluated to the satisfaction of the instructor.

CEMENT MASON'S

PROGRESS CHART

Section B
Concrete Materials

Student's Name	UNIT I Concrete Ingredients			UNIT II Mixing Concrete			UNIT III Admixtures			UNIT IV Specifications and Testing										
	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6					
Job	UNIT TEST			UNIT TEST			UNIT TEST			UNIT TEST	Make a Slump Test	Make a Cylinder Cast	Make a Flexural Test Specimen	Make an Air Test Using Air Indicator	Make an Air Test Using Volumetric Method					
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct			85% Correct			85% Correct			85% Correct	No Deviation	No Deviation	No Deviation	No Deviation	No Deviation					
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

HAND TOOLS
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify tools used by the cement mason. He should be able to match tools to specific jobs and to demonstrate the proper use of each tool, utilizing safe working practices. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with cement finishing work to the correct definitions.
2. Identify three types of straightedges.
3. List the advantages of a magnesium straightedge over a wood straightedge.
4. Match types of straightedges to specific jobs.
5. Identify three types of tampers.
6. Match types of tampers to specific jobs.
7. Identify two types of darbies.
8. List the advantages of a magnesium darby over a wood darby.
9. Match types of darbies to specific jobs.
10. Identify two types of bullfloats.
11. List the advantages of a magnesium bullfloat over a wood bullfloat.
12. Select specific jobs for a wood or magnesium bullfloat when given a list of jobs.
13. Identify five types of hand floats.
14. List the advantages of a magnesium hand float over a wood hand float.
15. Match types of hand floats to specific jobs.
16. Identify six types of trowels.
17. Match types of trowels to specific jobs.

18. Identify six types of edgers.

19. Match types of edgers to specific jobs.

20. Identify two types of jointers.

21. Match types of jointers to specific jobs.

22. Identify five types of combination tools.

23. Match types of combination tools to specific jobs.

24. Distinguish between a rubbing stone and a rubbing brick.

25. List three jobs where rubbing stones are used.

26. Identify three types of hammers.

27. Match types of hammers to specific jobs.

28. List the advantages of a scaling hammer over a brick hammer.

29. Identify thirteen miscellaneous tools.

30. List four basic rules concerning the care of hand tools.

31. List six basic rules concerning the safe use of hand tools.

HAND TOOLS
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide each student with objective sheet.
- B. Provide each student with information sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheets.
- F. Show examples of tools.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Types of Straightedges
  2. TM 2--Types of Tampers
  3. TM 3--Types of Darbies
  4. TM 4--Types of Bullfloats
  5. TM 5--Types of Hand Floats

6. TM 6--Types of Trowels
7. TM 7--Types of Edgers
8. TM 8--Types of Edgers (Continued)
9. TM 9--Types of Jointers
10. TM 10--Combination Tools
11. TM 11-Types of Rubbing Stones
12. TM 12--Types of Hammers
13. TM 13--Miscellaneous Tools
14. TM 14--Miscellaneous Tools (Continued)
15. TM 15--Miscellaneous Tools (Continued)

D. Test

E. Answers to test

II. References:

A. Goldblatt Tool Company. *Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1974.

B. Panarese, William C. *Outdoor Landscaping with Concrete.* Skokie, Illinois: Portland Cement Association, 1971.

C. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

HAND TOOLS
UNIT I

INFORMATION SHEET

I. Terms and definitions

7

A. Finishing--Process of working concrete to a hard, smooth surface

B. Straightedging--Process of leveling concrete with a straightedge

C. Tamp--Tool used to consolidate or compact low slump concrete

D. Low slump--Stiff concrete

E. Darby--Process of leveling high spots and/or ridges left by straightedge

F. Bullfloat--Process of leveling out concrete to a smooth surface

G. Slab--Poured concrete floor

H. Step riser--Upright or face part of a step

I. Mud--Mixture of sand, cement, and water

J. Patching--Process of filling form tie holes, honeycomb, and other defects in concrete

K. Grout--Mixture of sand and cement used to level base plates and equipment bases

(NOTE: There are also commercial types of grouting material.)

L. Honeycomb--Cavity or pit in concrete

M. Chipping hammer--Tool used to cut off projections on concrete

N. Groover--Another term for jointer

O. Jointer--Tool used to cut joints or grooves in concrete

P. Combination tool--Tool used to do two jobs at the same time

Q. Topping--Generally a commercial mixture used to top-floor surfaces to provide durability, safety, and beauty

R. Cove--Concave or radius at bottom section of curb, step, or base

S. Base--Bottom section of a wall

T. Rubbing--Process of rubbing or grinding concrete

U. Knee board--Tool used to kneel on while finishing concrete

INFORMATION SHEET

II. Types of straightedges (Transparency 1)

- A. Wood
- B. Magnesium
- C. Paver's

III. Advantages of a magnesium straightedge over a wood straightedge

- A. Works better on certain types of toppings
- B. Prevents drag
- C. Preferred when cutting joints because of accuracy

  (NOTE: Both the wood and magnesium straightedges can be used on the same type of concrete.)

IV. Types of jobs where straightedges are used

- A. Wood
  1. Floor slab
  2. Sidewalk
  3. Pavement
  4. Step
  5. Cutting joints
- B. Magnesium
  1. Floor slab
  2. Sidewalk
  3. Pavement
  4. Step
  5. Cutting joints
- C. Paver's--To check levelness of pavement

V. Types of tampers (Transparency 2)

- A. Hand
- B. Jitterbug
- C. Rollerbug

INFORMATION SHEET

VI. Types of jobs where tampers are used

  A. Hand--Small slabs with low slump concrete

  B. Jitterbug--Used on small jobs

    1. Floor slab

    2. Regular sidewalk and exposed aggregate sidewalk

    3. Driveway

  C. Rollerbug--Used on large jobs

    1. Floor slab

    2. Pavement

    3. Regular sidewalk and exposed aggregate sidewalk

VII. Types of darbies (Transparency 3)

  A. Wood

  B. Magnesium

VIII. Advantages of a magnesium darby over a wood darby

  A. Prevents drag

  B. Preferred on certain types of toppings and air-entrained concrete

  (NOTE: Both the wood and magnesium darbies can be used on the same type of concrete.)

IX. Types of jobs where darbies are used

  A. Wood

    1. Floor slab

    2. Pavement

    3. Sidewalk

    4. Porch

INFORMATION SHEET

B. Magnesium

1. Floor slab
2. Pavement
3. Sidewalk
4. Porch

X. Types of bullfloats (Transparency 4)

A. Wood

B. Magnesium

XI. Advantages of a magnesium bullfloat over a wood bullfloat

A. Works better on wet concrete

B. Is much lighter

C. Preferred for certain toppings and air-entrained concrete

D. Prevents drag

(NOTE: Both wood and magnesium bullfloats can be used on the same type of concrete.)

XII. Types of jobs where bullfloats are used

A. Wood

1. Floor slab
2. Pavement
3. Sidewalk

B. Magnesium

1. Floor slab
2. Pavement
3. Sidewalk

INFORMATION SHEET

XIII. Types of hand floats (Transparency 5)

- A. Wood
- B. Magnesium
- C. Cork
- D. Rubber and/or sponge
- E. Carpet

XIV. Advantages of a magnesium hand float over a wood hand float

- A. Preferred on certain types of toppings and air-entrained concrete
- B. Prevents drag

  (NOTE: Both wood and magnesium hand floats can be used on the same type of concrete.)

XV. Types of jobs where hand floats are used

- A. Wood
  - 1. Floor slab
  - 2. Pavement
  - 3. Sidewalk
  - 4. Step
  - 5. Windowsill
  - 6. Footing
- B. Magnesium
  - 1. Floor slab
  - 2. Pavement
  - 3. Sidewalk
  - 4. Step
  - 5. Windowsill

INFORMATION SHEET

- C. Cork
    - 1. Side of a wall
    - 2. Step riser and side
    - 3. Face of windowsill
    - 4. Face of curb
    - 5. Patching
- D. Rubber and/or sponge
    - 1. Side of a wall
    - 2. Step riser and side
    - 3. Face of windowsill
    - 4. Face of curb
    - 5. Patching
- E. Carpet--Side of a wall

    (NOTE: Each of the floats (cork, rubber, carpet) used on sidewalls gives a different type finish.)

XVI. Types of trowels (Transparency 6)

- A. Finishing
- B. Midget
- C. Pipe
- D. Margin
- E. Pointing
- F. Fresno

XVII. Types of jobs where trowels are used

- A. Finishing
    - 1. Floor slab
    - 2. Sidewalk
    - 3. Porch

INFORMATION SHEET

   4. Patio
   5. Step

B. Midget

   1. Step
   2. Windowsill
   3. Top of a wall
   4. Any other small job

C. Pipe

   1. Between pipes
   2. Step
   3. Place that is difficult to reach

      Example: Narrow walls and around forms

D. Margin

   1. Mixing mud
   2. Patching a hole
   3. Grouting a base
   4. Finishing a small floor patch
   5. Place that is difficult to reach

E. Pointing

   1. Patching a hole
   2. Grouting a base
   3. Place that is difficult to reach

F. Fresno

   1. Small floor slab
   2. Sidewalk
   3. Place that is difficult to get under

INFORMATION SHEET

XVIII. Types of edgers (Transparencies 7 and 8)

  A. Sidewalk
  B. Pavement
  C. Curb
  D. Step and windowsill
  E. Radius
  F. Walking

XIX. Types of jobs where edgers are used

  A. Sidewalk
    1. Floor slab
    2. Sidewalk
    3. Step
    4. Porch
    5. Patio
    6. Curb
    7. Wall
  B. Pavement
    1. Pavement
    2. Curb
    3. Driveway approach
    4. Garage apron
    5. Runway
  C. Curb
    1. Curb
    2. Pavement

INFORMATION SHEET

3. Driveway approach
4. Garage apron
5. Runway

D. Step and windowsill

1. Step
2. Windowsill
3. Small curb
4. Narrow wall
5. Threshold

E. Radius

1. Sidewalk
2. Pavement
3. Curb
4. Patio

F. Walking

1. Sidewalk
2. Pavement
3. Large slab
4. Runway

XX. Types of jointers (groovers) (Transparency 9)

A. Hand

B. Walking

XXI. Types of jobs where jointers are used

A. Hand

1. Sidewalk
2. Pavement

INFORMATION SHEET

    3. Floor slab
    4. Patio
  - B. Walking
    1. Sidewalk
    2. Pavement
    3. Floor slab

XXII. Types of combination tools (Transparency 10)

  - A. Edger/jointer
  - B. Curb and gutter
  - C. Step and sidewalk
  - D. Cove/base
  - E. Step and corner

XXIII. Types of jobs where combination tools are used

  - A. Edger/jointer
    1. Curb and sidewalk
    2. Step
  - B. Curb and gutter--Curb and gutter
  - C. Step and sidewalk
    1. Curb and sidewalk
    2. Step
  - D. Cove/base
    1. Cove and base
    2. Swimming pool

INFORMATION SHEET

- E. Step and corner
  - 1. Step
  - 2. Wall

XXIV. Types of rubbing stones (Transparency 11)

- A. Rubbing stone
- B. Fluted rubbing brick

XXV. Types of jobs where rubbing stones are used

- A. Rubbing stone
  - 1. Step
  - 2. Wall
  - 3. Ceiling
  - 4. Curb
  - 5. Column
  - 6. Windowsill
- B. Rubbing brick
  - 1. Wall
  - 2. Ceiling

XXVI. Types of hammers (Transparency 12)

- A. Brick (chipping hammer)
- B. Scaling (chipping hammer)
- C. Bush

XXVII. Types of jobs where hammers are used

- A. Brick
  - 1. Wall
  - 2. Ceiling
  - 3. Curb

INFORMATION SHEET

   4. Step
   5. Column

B. Scaling
   1. Wall
   2. Ceiling
   3. Curb
   4. Step
   5. Column

C. Bush
   1. Wall
   2. Column

XXVIII. Advantages of a scaling hammer over a brick hammer

A. Works better in corners

B. Works better in tight places

XXIX. Miscellaneous tools (Transparencies 13, 14, and 15)

A. Broom

B. Brush

C. Chisel

D. File

E. Shovel

F. Knee pads

G. Safety goggles

H. Dust mask

I. Safety helmet--Hard hat

J. Rubber gloves

K. Knee boards

INFORMATION SHEET

  - L. Folding rule
  - M. Tape

XXX. Basic rules concerning the care of hand tools

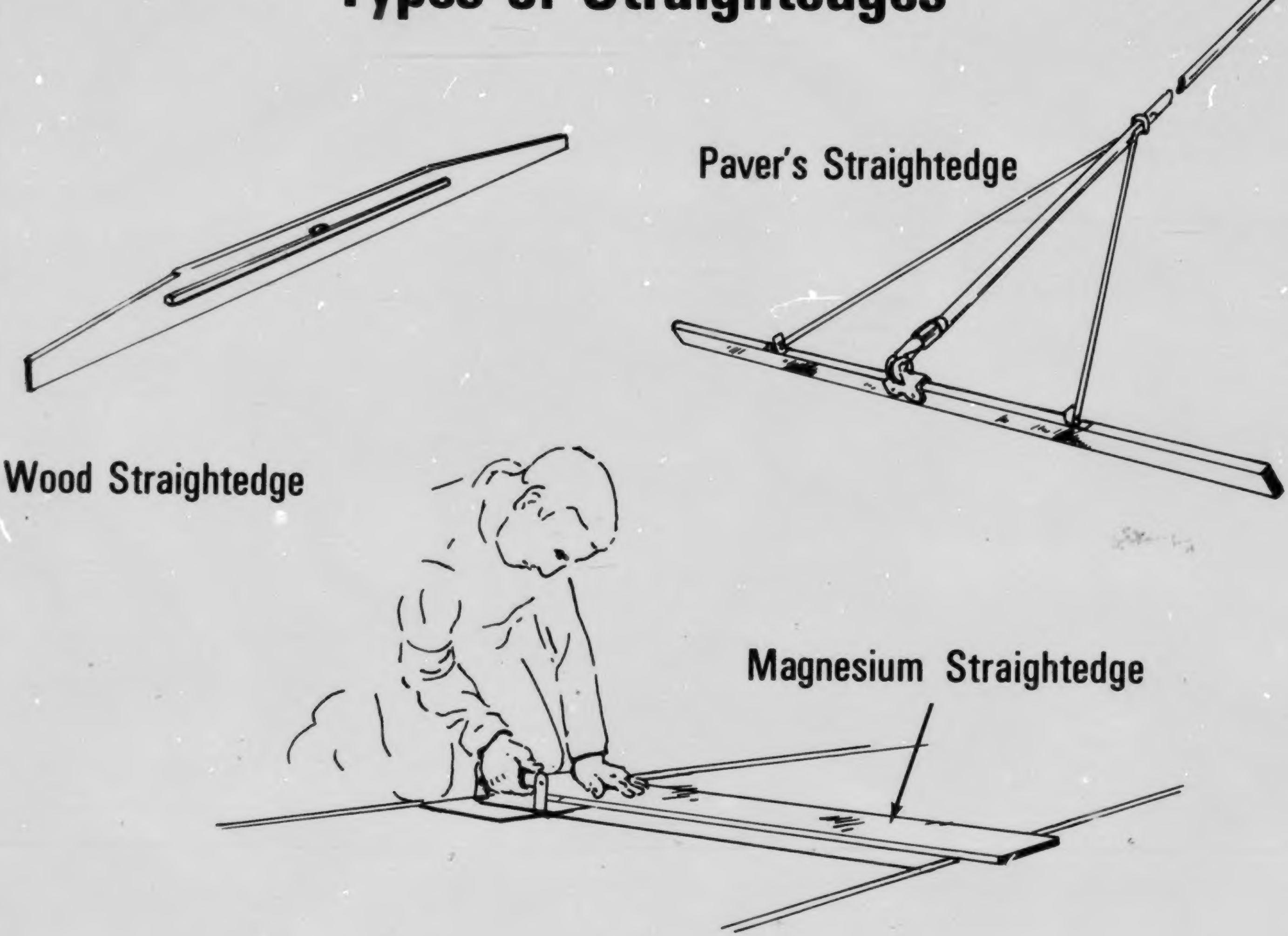
  - A. Keep trowel edges filed
  - B. Keep tools clean
  - C. Do not carry finishing trowel in pocket
  - D. Use tool only for its specific job

XXXI. Basic rules concerning the safe use of hand tools

  - A. Use the right tool for the right job
  - B. Do not use trowels with ragged edges or loose rivets
  - C. Do not use broken tools
  - D. Do not use hand floats with loose or protruding screws
  - E. Do not throw tools
  - F. Be sure everything and everyone is clear behind you when using long handled tools such as a bullfloat or rollerbug

    (NOTE: Insulated and/or wooden handles must be used around all electrical equipment.)

Types of Straightedges

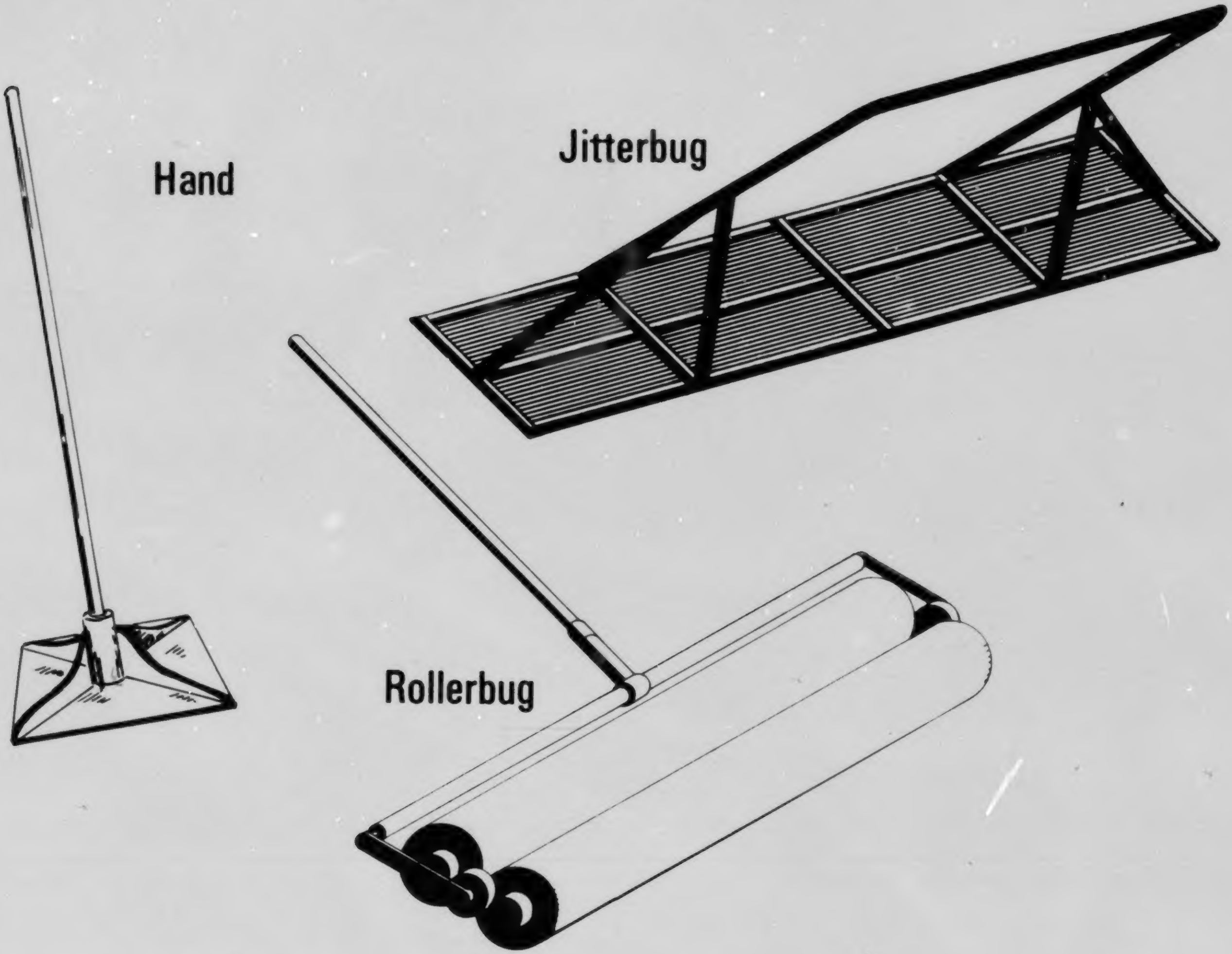


Paver's Straightedge

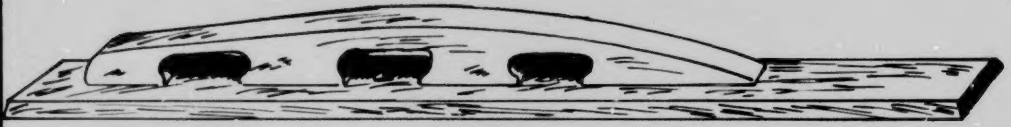
Wood Straightedge

Magnesium Straightedge

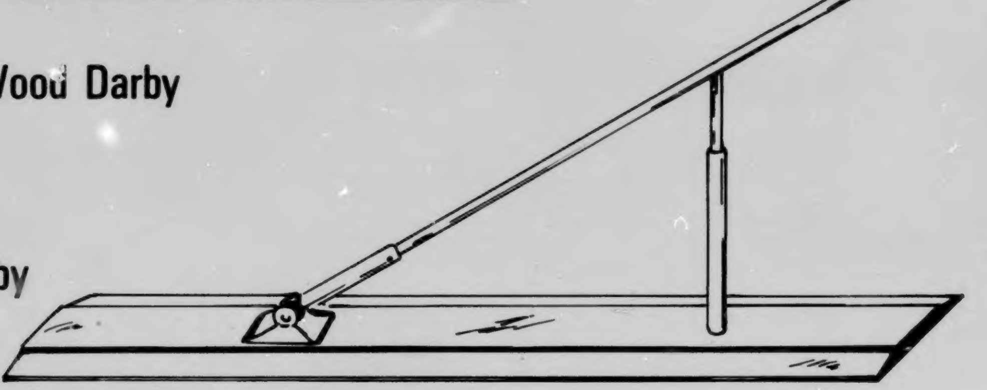
Types of Tampers


Hand
Jitterbug
Rollerbug

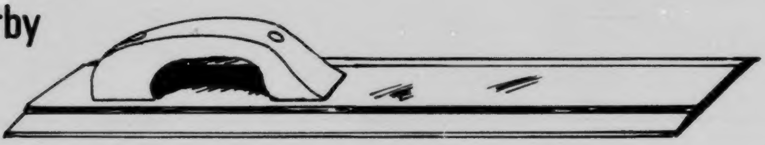
Types of Darbies



Wood Darby

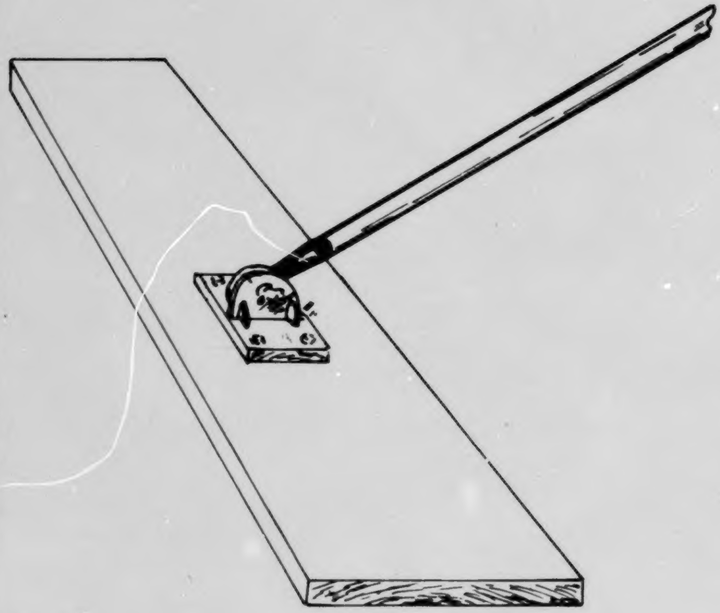


Magnesium Darby

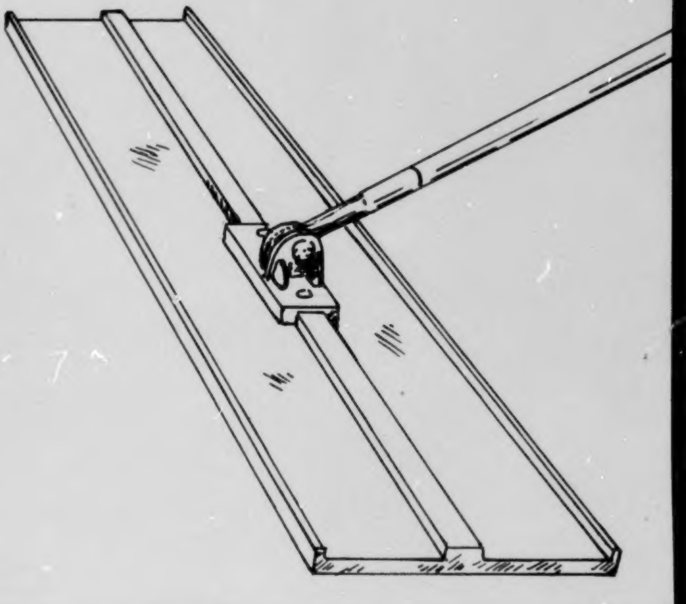


Magnesium Hand Darby

Types of Bullfloats

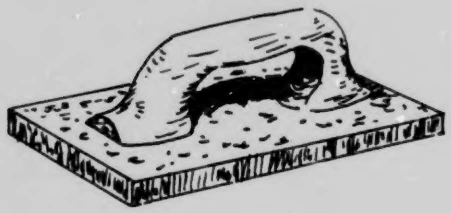


Wood Bullfloat

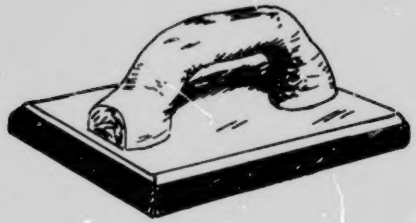


Magnesium Bullfloat

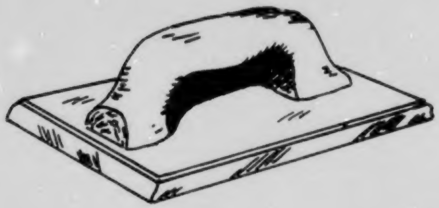
Types of Hand Floats



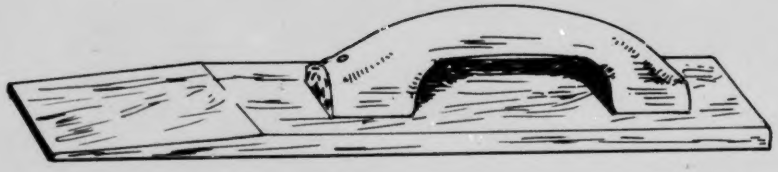
Cork Float



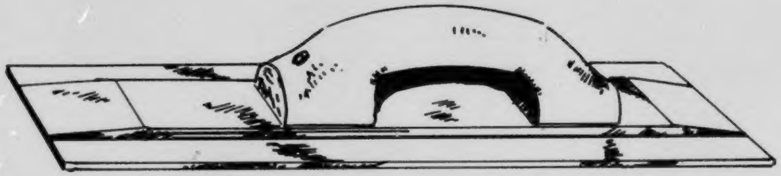
Rubber/Sponge Float



Carpet Float

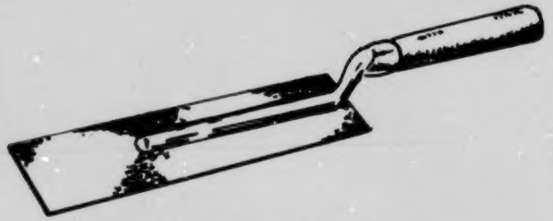


Wood Float

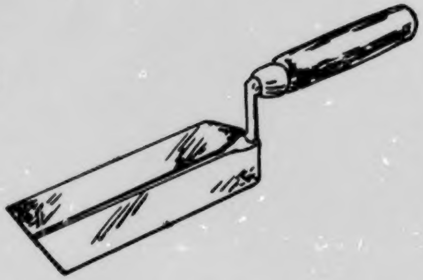


Magnesium Float

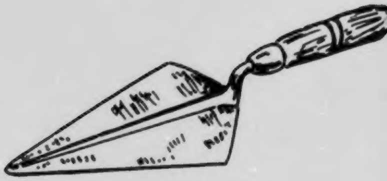
Types of Trowels



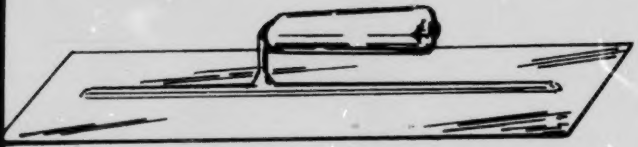
Pipe Trowel



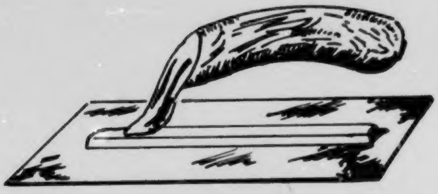
Margin Trowel



Pointing Trowel

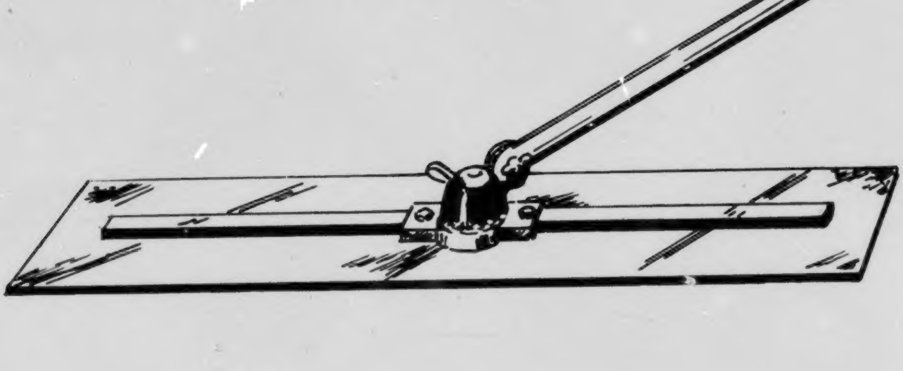


Finishing Trowel

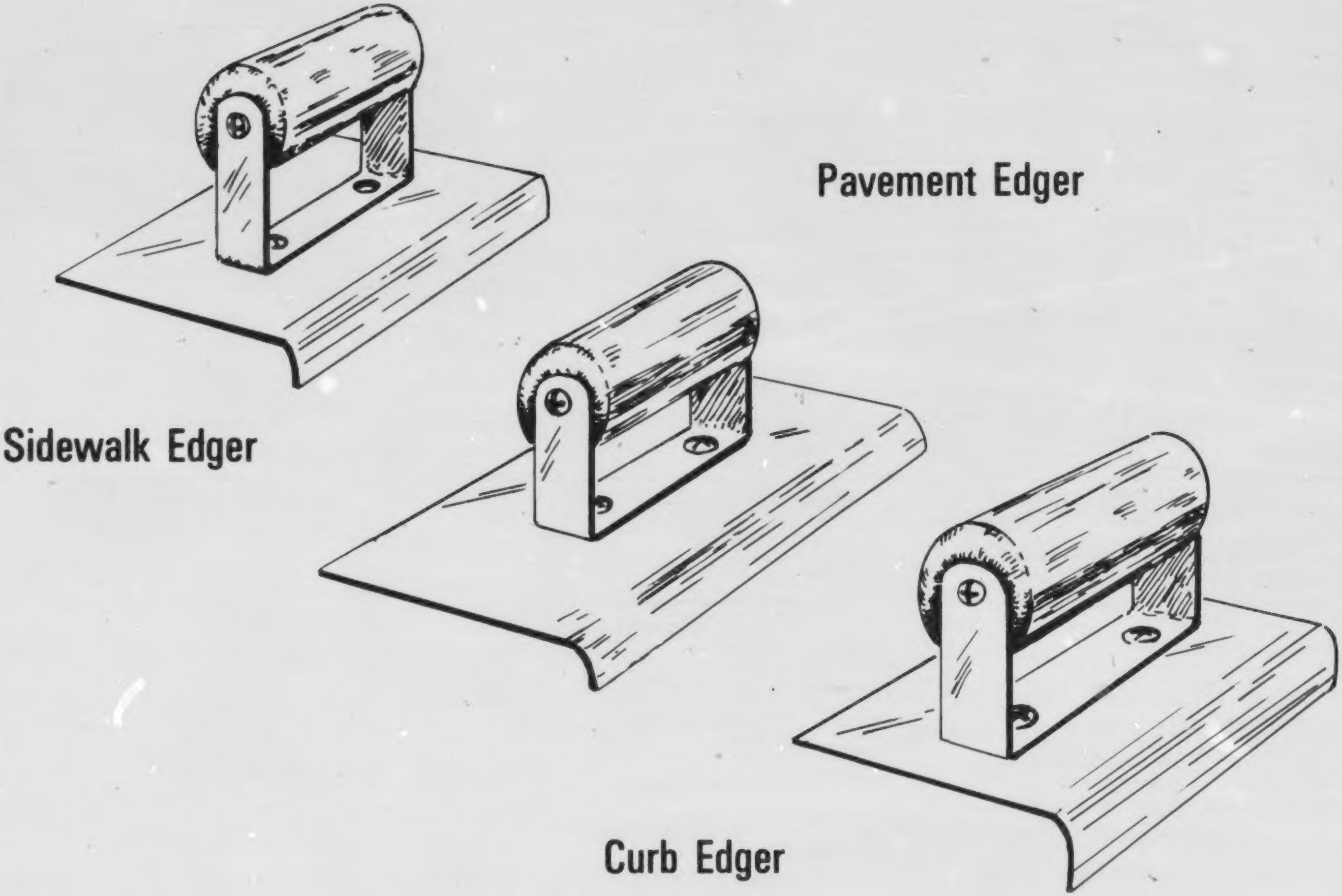


Midget Trowel

Fresno Trowel



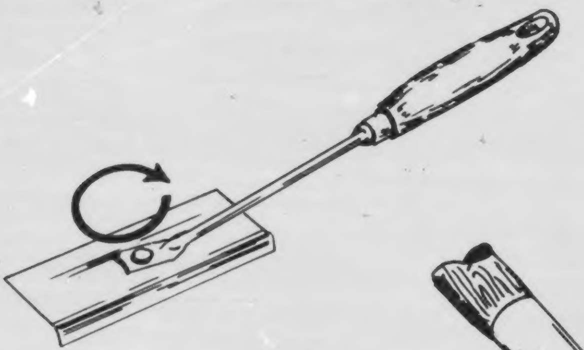
Types of Edgers

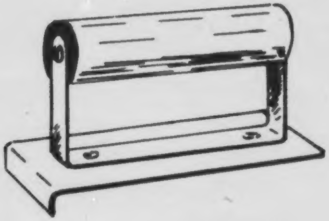

Pavement Edger
Sidewalk Edger
Curb Edger

Types of Edgers

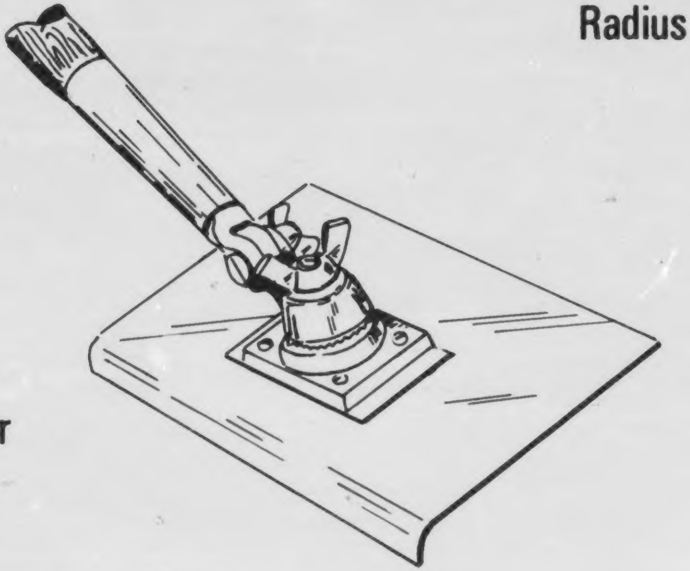
(Continued)

Step and Windowsill Edger



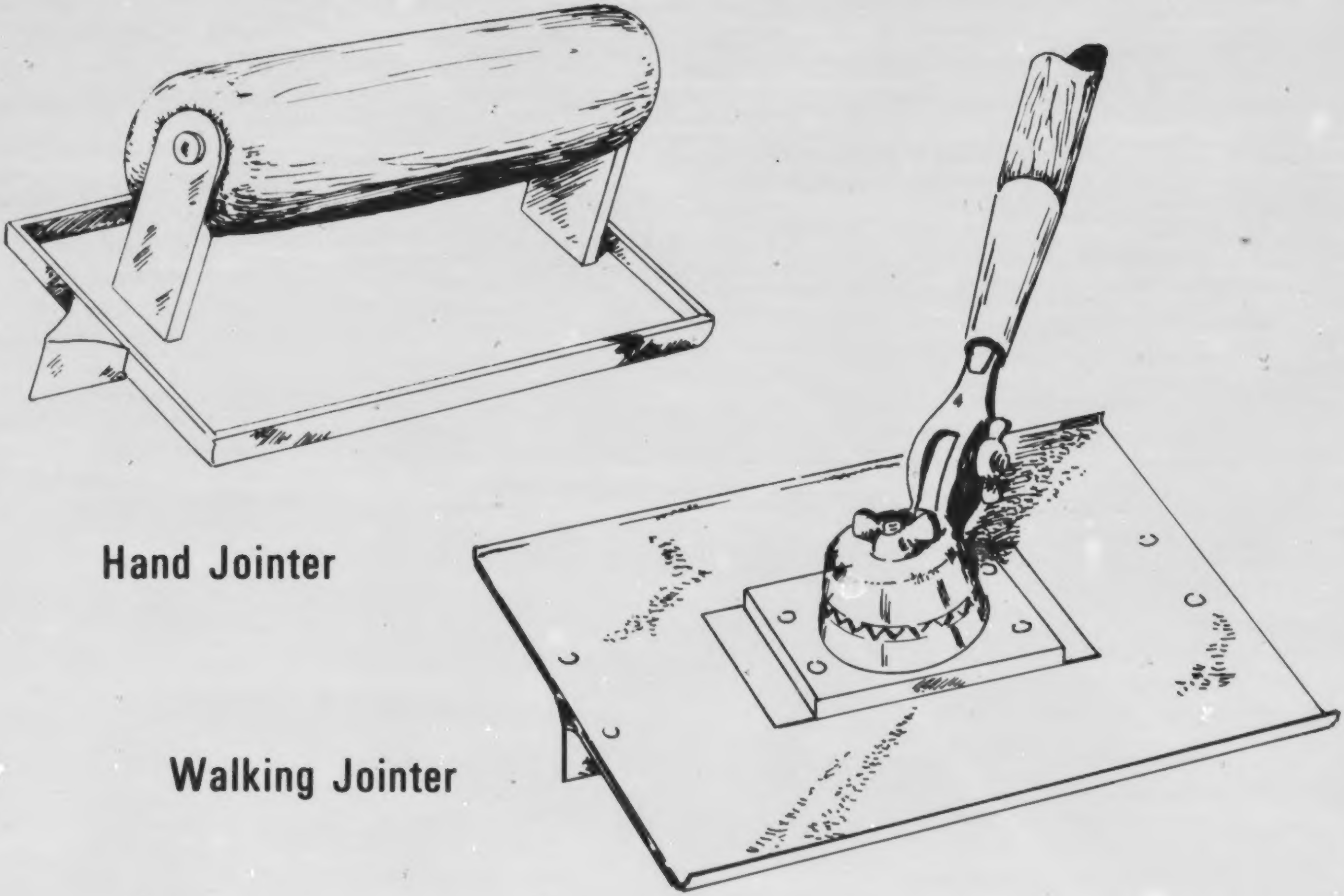


Radius Edger

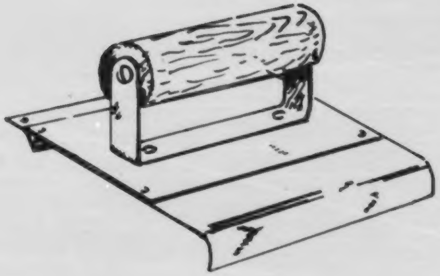


**Walking
Edger**

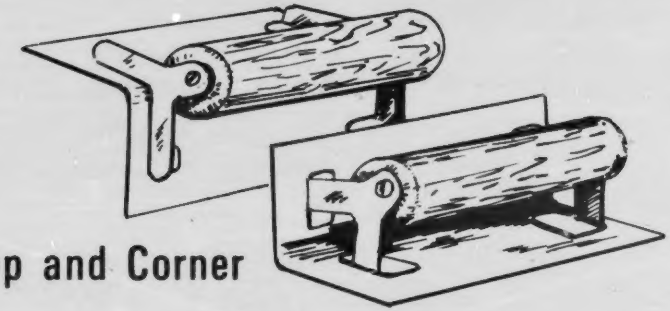
Types of Jointers


Hand Jointer
Walking Jointer

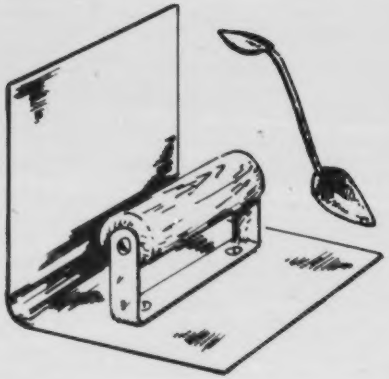
Combination Tools



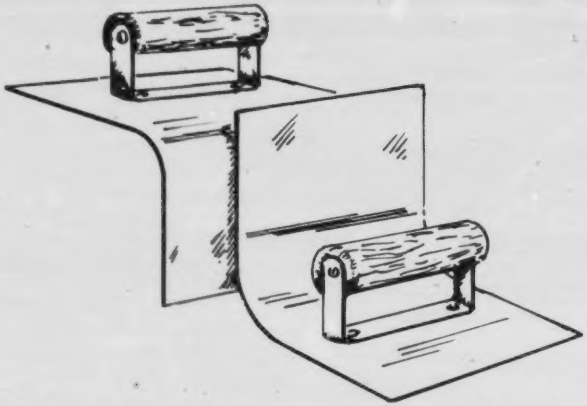
Edger/Jointer



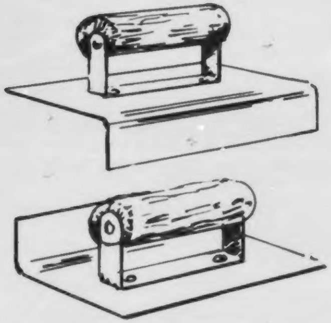
Step and Corner



Cove/ Base

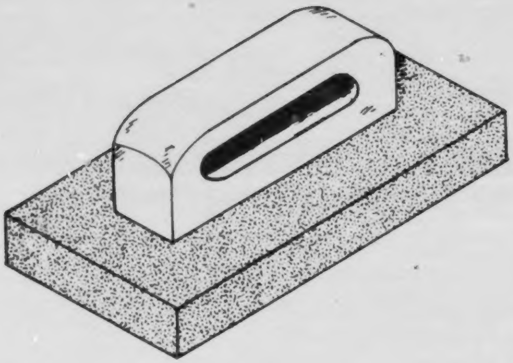


Curb and Gutter

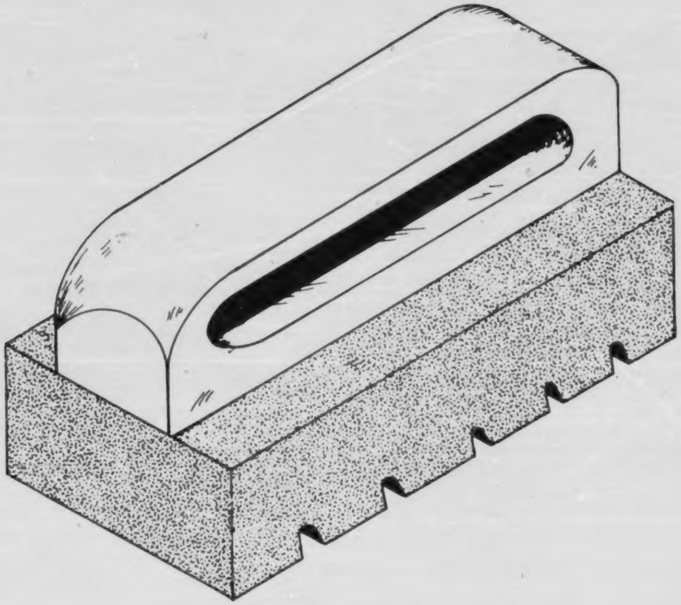


Step and Sidewalk

Types of Rubbing Stones

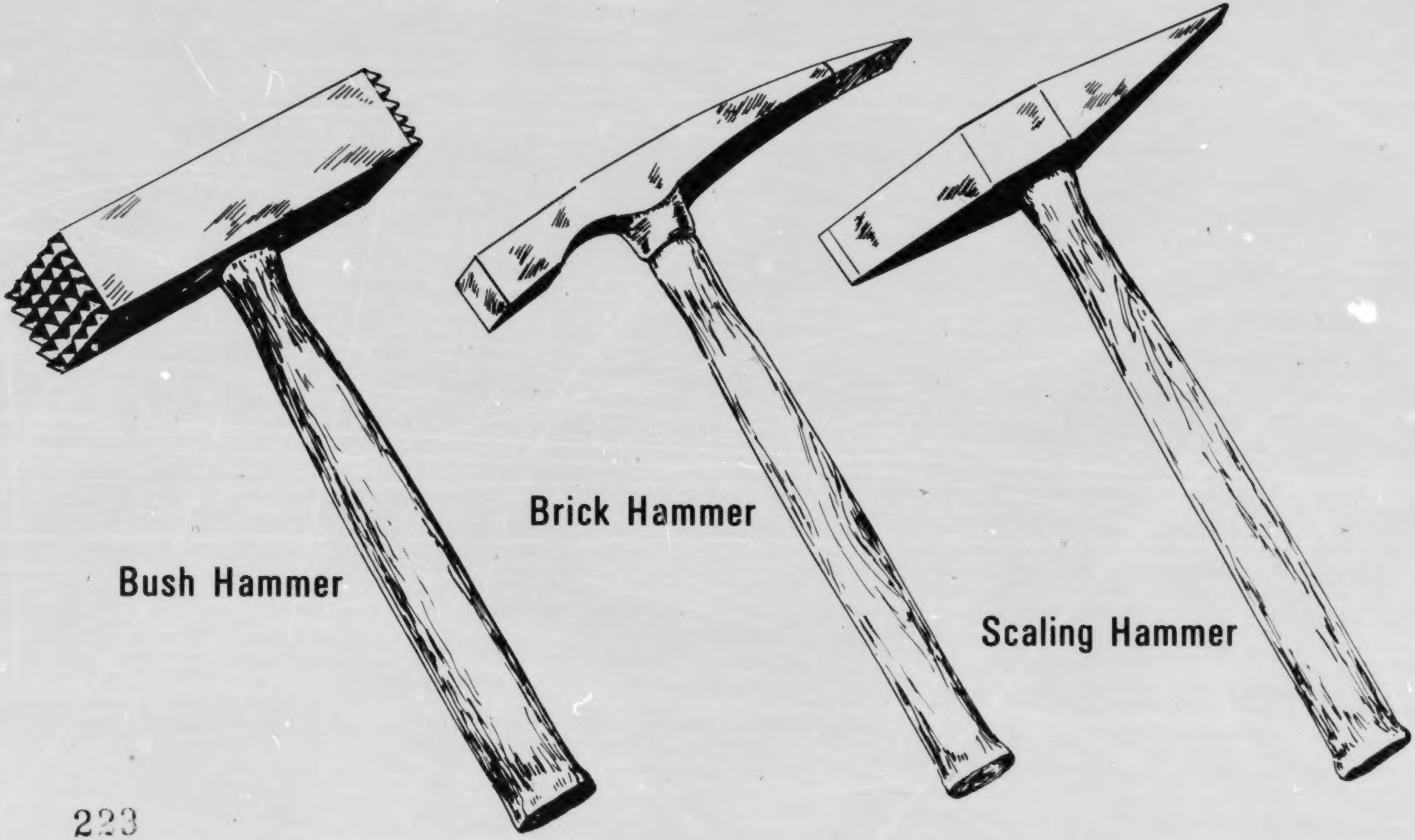


Rubbing Stone

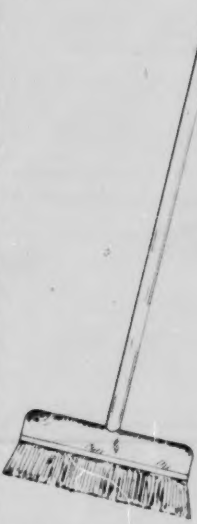


Fluted Rubbing Brick

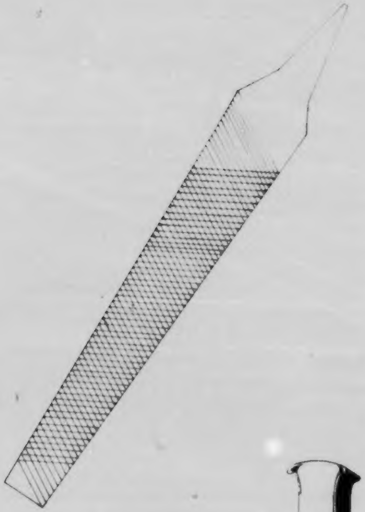
Types of Hammers


Brick Hammer
Bush Hammer
Scaling Hammer

Miscellaneous Tools



Broom



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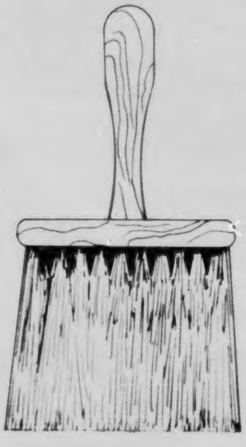
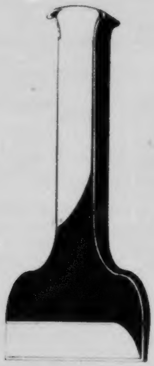


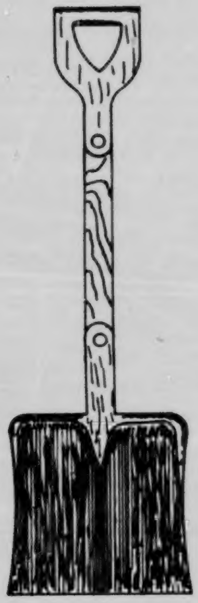
Brush



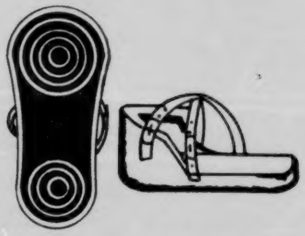
Chisel

Miscellaneous Tools

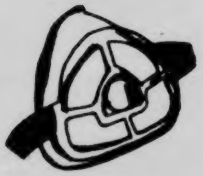
(Continued)



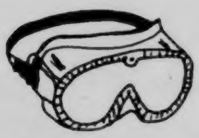
Shovel



Knee Pads



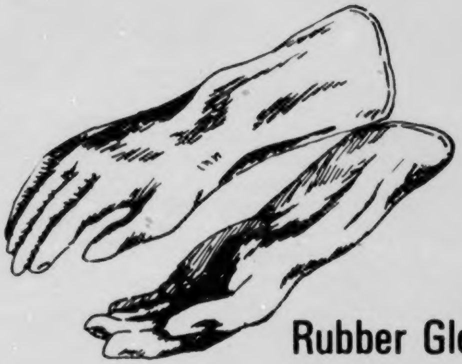
Dust Mask



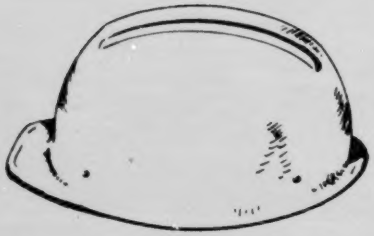
Safety Goggles

Miscellaneous Tools

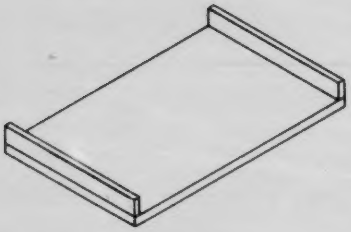
(Continued)



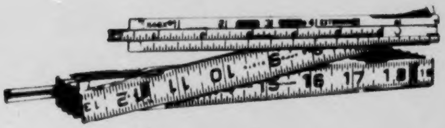
Rubber Gloves



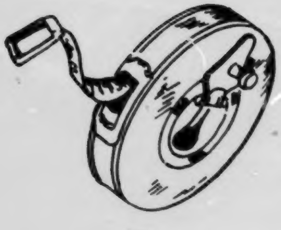
Safety Helmet - Hard Hat



Knee Boards



Folding Rule



Tape

HAND TOOLS
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

_____a. Tool used to kneel on while finishing concrete

_____b. Process of working concrete to a hard, smooth surface

_____c. Process of rubbing or grinding concrete

_____d. Process of leveling concrete with a straightedge

_____e. Bottom section of a wall

_____f. Tool used to consolidate or compact low slump concrete

_____g. Concave or radius at bottom section of curb, step, or base

_____h. Stiff concrete

_____i. Tool used to do two jobs at the same time

_____j. Process of leveling high spots and/or ridges left by straightedge

_____k. Another term for jointer

_____l. Process of leveling concrete to a smooth surface

_____m. Tool used to cut off projections on concrete

_____n. Poured concrete floor

_____o. Cavity or pit in concrete

_____p. Upright or face part of a step

_____q. Mixture of sand and cement used to level base plates and equipment bases

1. Grout
2. Patching
3. Honeycomb
4. Mud
5. Chipping hammer
6. Step riser
7. Combination tool
8. Slab
9. Groover
10. Low slump
11. Cove
12. Tamp
13. Base
14. Bullfloat
15. Darby
16. Rubbing
17. Topping
18. Straightedging
19. Knee board
20. Finishing
21. Jointer

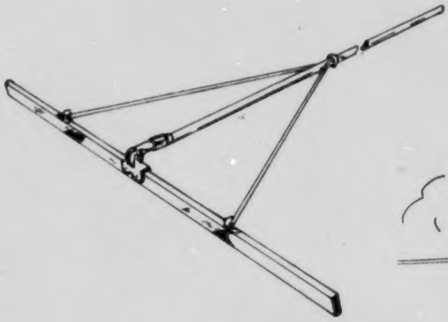
_____r. Process of filling form tie holes, honeycomb, and other defects in concrete

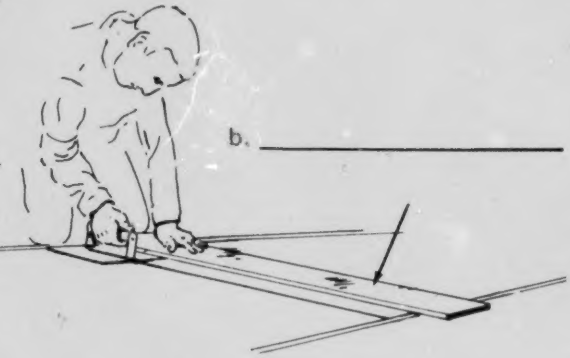
_____s. Mixture of sand, cement, and water

_____t. Generally a commercial mixture used to top-floor surfaces to provide durability, safety, and beauty

_____u. Tool used to cut joints or grooves in concrete

2. Identify the three types of straightedges below.





b. ______________________

a. ______________________

c. ______________________

3. List the advantages of a magnesium straightedge over a wood straightedge.

a.

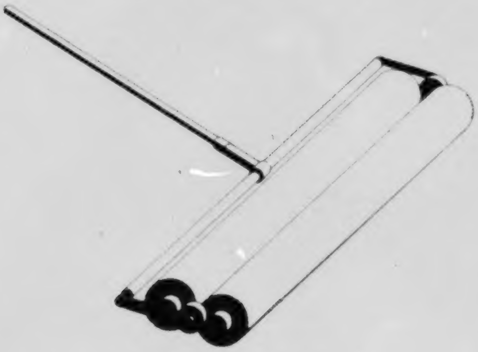
b.

c.

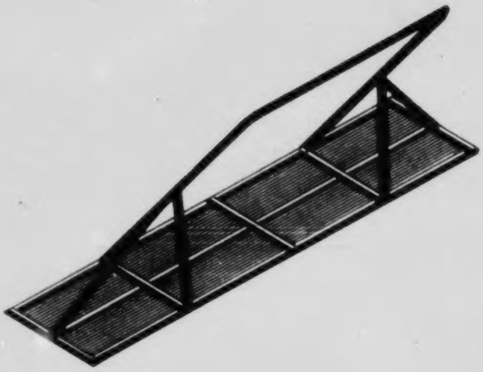
4. Match the type of straightedge on the right to a specific job by placing the appropriate number or numbers in the blanks provided.

_____a. To check levelness of pavement	1. Wood
_____b. Sidewalk	2. Magnesium
_____c. Cutting joints	3. Paver's

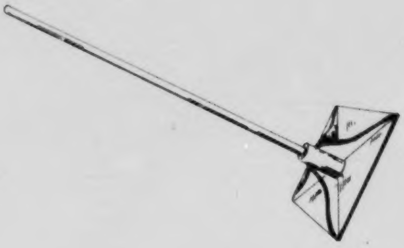
5. Identify the three types of tampers below.



a. ______________________________



b. ______________________________



c. ______________________________

6. Match the type of tamper on the right to a specific job by placing the appropriate number or numbers in the blanks provided.

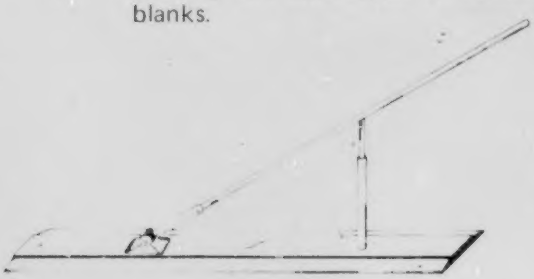
_____a. Floor slab

_____b. Regular sidewalk and exposed aggregate sidewalk

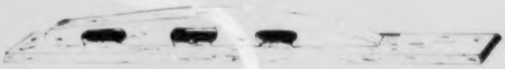
_____c. Small slabs with low slump concrete

1. Hand
2. Jitterbug
3. Rollerbug

7. Identify the two types of darbies below by writing the correct names in the blanks.



a. ______________________________



b. ______________________________

8. List the advantages of a magnesium darby over a wood darby.

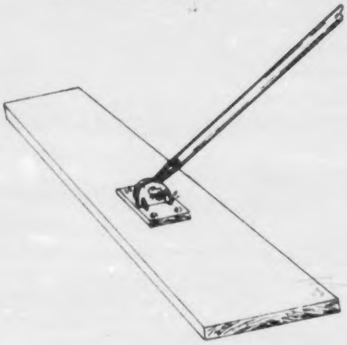
   a.

   b.

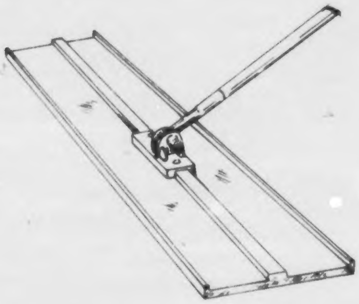
9. Match the type of darby on the right to the specific job by placing the appropriate number or numbers in the blanks provided.

______a. Porch	1. Wood
______b. Pavement	2. Magnesium

10. Identify the two types of bullfloats below by writing the correct name in the blank provided.



a. ______________________________



b. ______________________________

11. List the four advantages of a magnesium bullfloat over a wood bullfloat.

   a.

   b.

   c.

   d.

12. Select three specific jobs for a wood or magnesium bullfloat from the list below. Circle the correct letters.

   a. Sidewalk

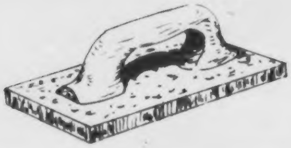
   b. Curb

   c. Windowsill

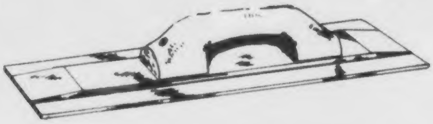
   d. Floor slab

   e. Pavement

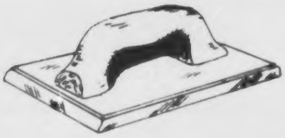
13. Identify the five types of hand floats below by writing the correct name in the blank provided.



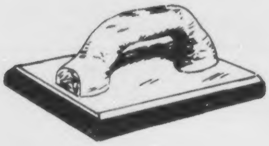
a. ______________________



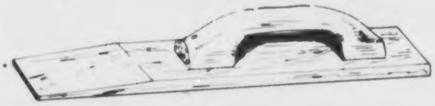
b. ______________________



c. ______________________



d. ______________________



e. ______________________

14. List the two advantages of a magnesium hand float over a wood hand float.

a.

b.

15. Match the type of hand float on the right to the correct job by placing the appropriate number or numbers in the blanks provided.

_____a. Patching

_____b. Footing

_____c. Side of a wall

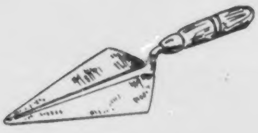
_____d. Floor slab

_____e. Windowsill

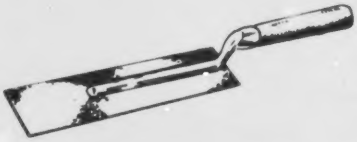
_____f. Face of windowsill

1. Wood
2. Magnesium
3. Cork
4. Rubber/sponge
5. Carpet

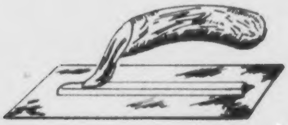
16. Identify the six types of trowels below by writing the correct name in the blank.



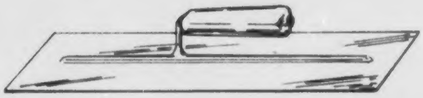
a. ______________________________



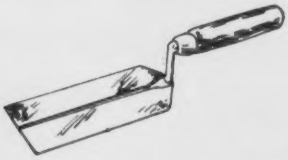
b. ______________________________



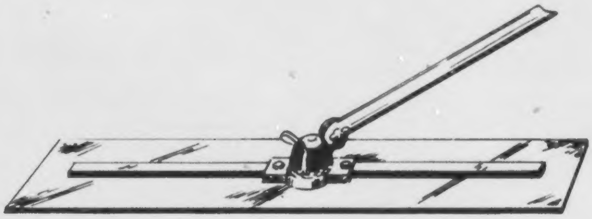
c. ______________________________



d. ______________________________



e. ______________________________



f. ______________________________

17. Match the type of trowel on the right to the correct job by placing the correct number or numbers in the blank.

_____a. Mixing mud

_____b. Place that is difficult to get under

_____c. Windowsill

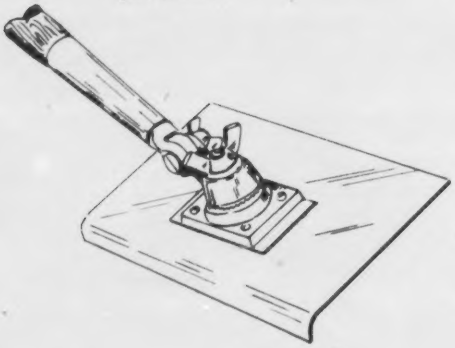
_____d. Floor slab

_____e. Between pipes

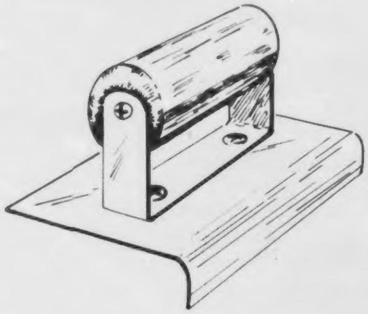
_____f. Grouting a base

1. Finishing
2. Midget
3. Pipe
4. Margin
5. Pointing
6. Fresno

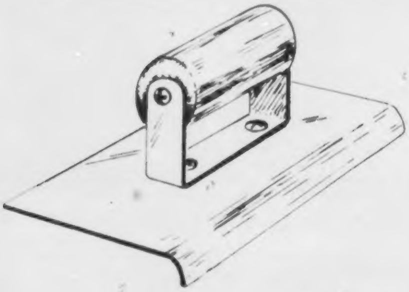
18. Identify the six types of edgers below by writing the correct name in the blank provided.



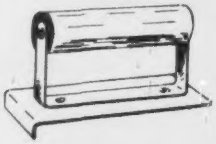
a. ______________________________



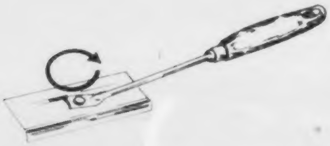
b. ______________________________



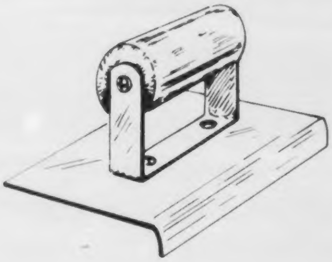
c. ______________________________



d. ______________________________



e. ______________________________



f. ______________________________

19. Match the type of edger on the right to the correct job by placing the appropriate number or numbers in the blanks provided.

______a. Runway

______b. Wall

______c. Sidewalk

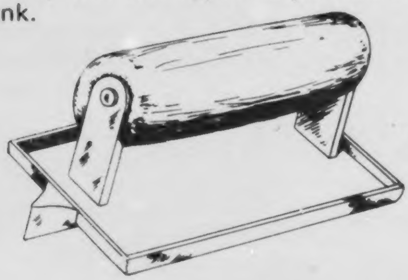
______d. Curb

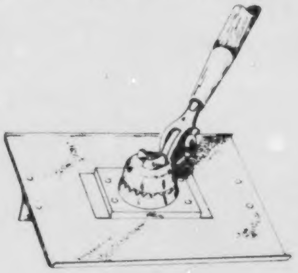
______e. Large slab

______f. Windowsill

1. Sidewalk
2. Pavement
3. Curb
4. Step and windowsill
5. Radius
6. Walking

20. Identify the two types of jointers below by writing the correct name in the blank.





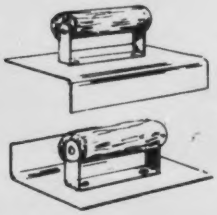
a. ______________________________ b. ______________________________

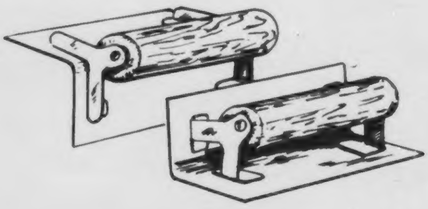
21. Match the type of jointer on the right to the correct job by placing the appropriate number or numbers in the blank.

_____a. Pavement   1. Hand

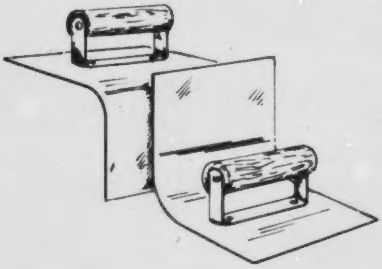
_____b. Patio   2. Walking

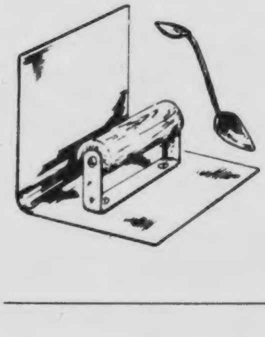
22. Identify the five types of combination tools below by writing the correct name in the blank.



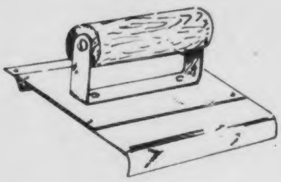


a. ______________________________ b. ______________________________





d. ______________________________



c. ______________________________

e. ______________________________

23. Match the type of combination tool on the right to the correct job by placing the appropriate number or numbers in the blanks.

______a. Wall

______b. Swimming pool

______c. Curb and gutter

______d. Step

______e. Curb and sidewalk

1. Edger/jointer

2. Curb and gutter

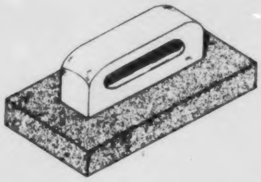
3. Step and sidewalk

4. Cove/base

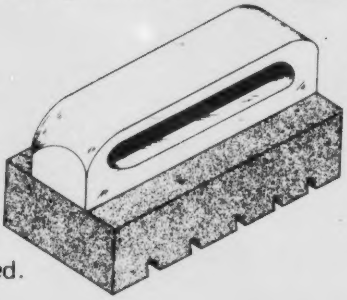
5. Step and corner

24. Distinguish between a rubbing stone and a rubbing brick. Circle the letter of the rubbing stone.

a.



b.



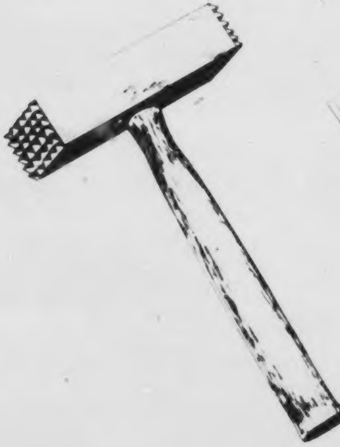
25. List three jobs where rubbing stones are used.

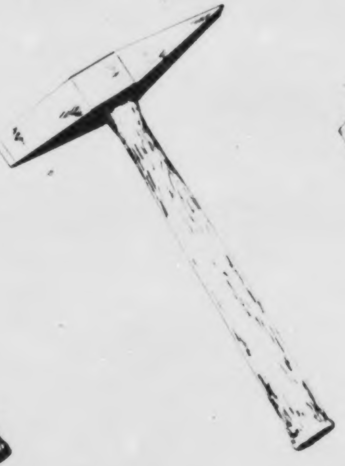
a.

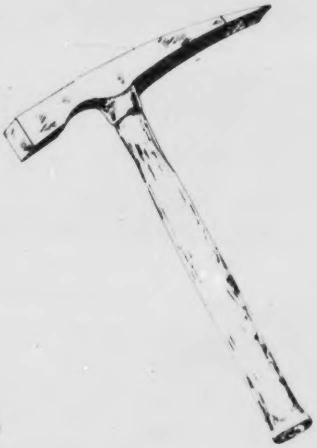
b.

c.

26. Identify the three types of hammers below by writing the correct name in the blank.







a. ______________________ b. ____________________ c. ____________________

27. Match the type of hammer on the right to the correct job by placing the appropriate number or numbers in the blanks.

______a. Step 1. Brick

______b. Column 2. Scaling

______c. Wall 3. Bush

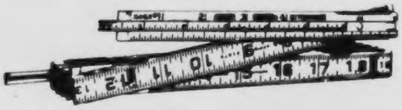
28. List the advantages of a scaling hammer over a brick hammer.

a.

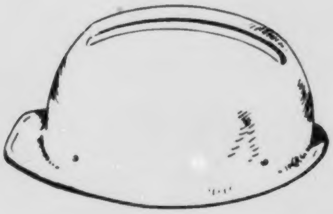
b.

29. Identify thirteen miscellaneous tools.

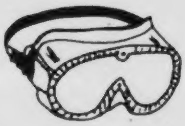
a. ____________



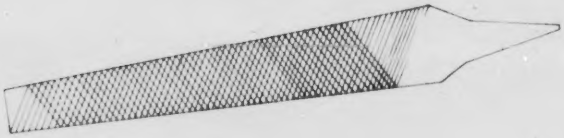
b. ____________



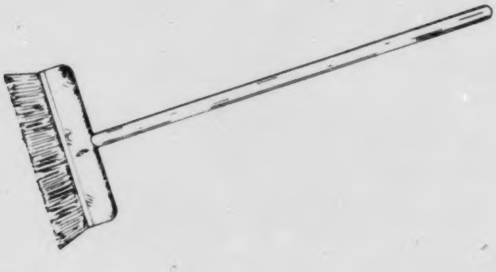
c. ____________



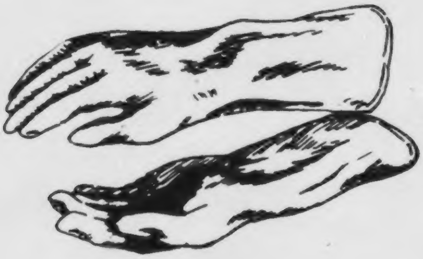
d. ____________



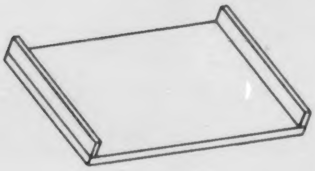
e. ____________



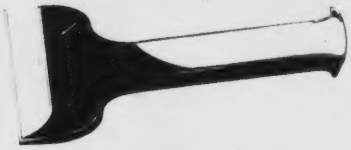
f. ____________



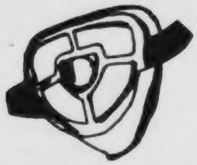
g. ____________



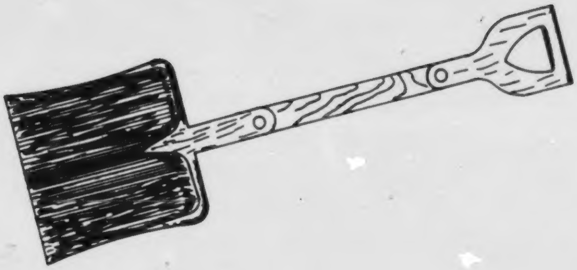
h. ____________



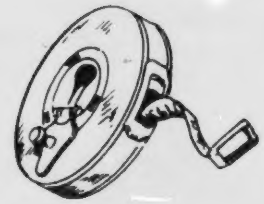
i. ____________



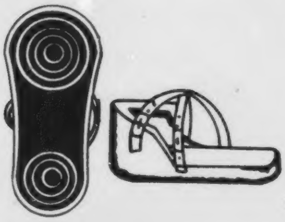
j. ____________



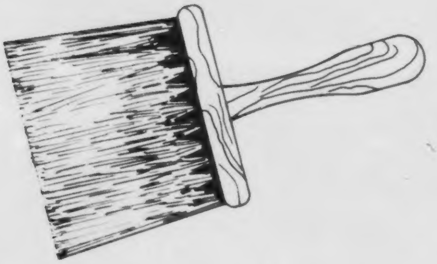
k. ____________



l. ____________



m. ____________



30. List four basic rules concerning the care of hand tools.

a.

b.

c.

d.

31. List six basic rules concerning the safe use of hand tools.

a.

b.

c.

d.

e.

f.

HAND TOOLS
UNIT I

ANSWERS TO TEST

1. a. 19
   b. 20
   c. 16
   d. 18
   e. 13
   f. 12
   g. 11
   h. 10
   i. 7
   j. 15
   k. 9
   l. 14
   m. 5
   n. 8
   o. 3
   p. 6
   q. 1
   r. 2
   s. 4
   t. 17
   u. 21

2. a. Paver's
   b. Magnesium
   c. Wood

3. a. Works better on certain types of toppings
   b. Prevents drag
   c. Preferred when cutting joints because of accuracy

4. a. 3
   b. 1, 2
   c. 1, 2

5. a. Rollerbug
   b. Jitterbug
   c. Hand

6. a. 2, 3
   b. 2, 3
   c. 1

7. a. Magnesium
   b. Wood

8. a. Prevents drag
   b. Preferred on certain types of toppings and air-entrained concrete

9. a. 1, 2
   b. 1, 2
10. a. Wood
    b. Magnesium
11. a. Works better on wet concrete
    b. Is much lighter
    c. Preferred for certain toppings and air-entrained concrete
    d. Prevents drag
12. a
    d
    e
13. a. Cork
    b. Magnesium
    c. Carpet
    d. Rubber/sponge
    e. Wood
14. a. Preferred on certain types of toppings and air-entrained concrete
    b. Prevents drag
15. a. 3, 4
    b. 1
    c. 3, 4, 5
    d. 1, 2
    e. 1, 2
    f. 3, 4

16. a. Pointing
    b. Pipe
    c. Midget
    d. Finishing
    e. Margin
    f. Fresno

17. a. 4
    b. 6
    c. 2
    d. 1, 6
    e. 3
    f. 4, 5

18. a. Walking
    b. Curb
    c. Pavement
    d. Radius
    e. Step and windowsill
    f. Sidewalk

19. a. 2, 3, 6
    b. 1, 4
    c. 1, 5, 6
    d. 1, 2, 3, 4, 5
    e. 6
    f. 4

20. a. Hand
    b. Walking

21. a. 1, 2

b. 1

22. a. Step and sidewalk

b. Step and corner

c. Cove/base

d. Curb and gutter

e. Edger/jointer

23. a. 5

b. 4

c. 2

d. 1, 3, 5

e. 1, 3

24. a

25. Any three of the following are acceptable.

a. Step

b. Wall

c. Ceiling

d. Curb

e. Column

f. Windowsill

26. a. Bush

b. Scaling

c. Brick

27. a. 1, 2

b. 1, 2, 3

c. 1, 2, 3

28. a. Works better in corners
    b. Works better in tight places

29. a. Folding rule
    b. Safety helmet--Hard hat
    c. Safety goggles
    d. File
    e. Broom
    f. Rubber gloves
    g. Knee boards
    h. Chisel
    i. Dust mask
    j. Shovel
    k. Tape
    l. Knee pads
    m. Brush

30. a. Keep trowel edges filed
    b. Keep tools clean
    c. Do not carry finishing trowel in pocket
    d. Use tool only for its specific job

31. a. Use the right tool for the right job
    b. Do not use trowels with ragged edges or loose rivets
    c. Do not use broken tools
    d. Do not use hand floats with loose or protruding screws
    e. Do not throw tools
    f. Be sure everything and everyone is clear behind you when using long handled tools such as a bullfloat or rollerbug

POWER TOOLS
UNIT II

TERMINAL OBJECTIVES

After the completion of this unit, the student should be able to identify power tools used by the cement mason. He should be able to match the tools to the specific jobs and to demonstrate the ability to use the tools safely and correctly. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with power tools to the correct definitions.
2. Identify the types of straightedges.
3. State the purpose of a straightedge.
4. List the types of jobs where straightedges are used.
5. Identify two types of power floats.
6. List the types of jobs where power floats are used.
7. Identify three types of power troweling machines.
8. Match types of power troweling machines to specific jobs.
9. Identify the types of power grinders.
10. Match types of power grinders to specific jobs.
11. Identify three types of sprayers.
12. State the purpose of a power sprayer in concrete work.
13. Identify the types of power hammers.
14. State two purposes of a power hammer.
15. Identify the three types of concrete saws.
16. State three purposes of concrete saws.
17. Identify miscellaneous power tools.

18. Identify related tools and equipment.

19. List the basic rules concerning the care of power tools.

20. List the basic rules concerning the safe use of power tools.

POWER TOOLS
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information sheet.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Show examples of as many tools as possible.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Types of Straightedges
      2. TM 2--Types of Power Floats
      3. TM 3--Types of Power Troweling Machines
      4. TM 4--Types of Power Grinders
      5. TM 5--Types of Power Grinders (Continued)
      6. TM 6--Types of Sprayers
      7. TM 7--Types of Power Hammers
      8. TM 8--Types of Concrete Saws

9. TM 9--Miscellaneous Power Equipment
10. TM 10--Miscellaneous Power Equipment (Continued)
11. TM 11--Miscellaneous Power Equipment (Continued)
12. TM 12--Related Tools and Equipment
13. TM 13--Related Tools and Equipment (Continued)
14. TM 14--Related Tools and Equipment (Continued)
15. TM 15--Related Tools and Equipment (Continued)
16. TM 16--Related Tools and Equipment (Continued)
17. TM 17--Related Tools and Equipment (Continued)

D. Test

E. Answers to test

II. References:

A. Power Curbers, Inc. *News from the Gutter.* Fall, 1971, Vol. 9, No. 1.

B. Champion Manufacturing Company. *Champion Con-Trow'ls.* 3700 Forest Park Avenue, St. Louis, Missouri 63108.

C. Goldblatt Tool Company. *Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Co., 1974.

D. Equipment Development Co. "EDCO Model E-6 Edge and Base Grinder." 2700 Garfield Avenue, Silver Spring, Maryland.

E. Austin Brothers Manufacturing Co., Inc. *Austin Vibra-Tamp Cement Concrete Surfacing Machine.* 260 N. Pennsylvania Street, Colton, CA. 92324.

F. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

G. *Concrete Technology: Instructor's Guide.* Skokie, Illinois: Portland Cement Association, 1965.

H. *Automatic Curb and Gutter Machines.* Salisbury, North Carolina: Power Curbers, Inc., 1965.

POWER TOOLS
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Kelly float--Tool used to compact and float regular concrete and special types of toppings

(NOTE: Two special types of toppings are hardeners and colors.)

B. Riding trowel--Machine with three trowels in one unit; controlled with foot pedals and stick by the operator

C. Ceiling grinder--Tool devised to grind ceilings; mounted on wheels for easy movement

(NOTE: The grinder is run by an electric motor with a flexible shaft attached to the grinder head.)

D. Vibrator type grinder--Tool operated by a gas type vibrator; devised to run at slow speed for wet grinding

E. Sandblasting--Process used to cut off the surface of concrete

(NOTE: The sandblasting machine is operated by a pneumatic pump that forces silica sand with enough pressure to cut the surface of concrete.)

F. Shotcrete--Term used to designate pneumatically applied concrete; process used to apply cement mixture by compressed air

G. Slabjacking--Process of pumping grout under a slab to raise it back to its proper grade

H. Vibra-tamp--Power tool used to cut off humps on slabs and to disburse excess concrete into low areas, leaving an evenly tamped and level surface

I. Control joint--Joint cut in concrete to form a plane of weakness where a crack will occur

J. Decorative joint--Joint cut strictly for looks or decorative purposes

K. Bushhammer--Process used to remove surface film and fracture surface aggregate to produce a textured and colorful surface

L. Monomolecular film--Compound sprayed on fresh concrete to reduce rapid evaporation

INFORMATION SHEET

II. Types of straightedges (Transparency 1)
  A. Power
  B. Roller
  C. Vibrating
  D. Slip form paver

III. Purpose of a straightedge--To level concrete slabs

IV. Types of jobs where straightedges are used
  A. Floor slab
  B. Sidewalk
  C. Pavement
  D. Runway

V. Types of power floats (Transparency 2)
  A. Kelly float
  B. Trowel machine with float blades

VI. Types of jobs where power floats are used
  A. Special toppings and color work
  B. Finishing floor slabs

  (NOTE: Power floats are used mainly in floor slab and pavement construction.)

VII. Types of power troweling machines (Transparency 3)
  A. Trowel machine
  B. Pony trowel
  C. Riding trowel

INFORMATION SHEET

VIII. Types of jobs where power troweling machines are used

- A. Regular floor slab--Trowel machine
- B. Very small floor slab--Pony trowel
- C. Very large commercial slab work--Riding trowel

IX. Types of power grinders (Transparencies 4 and 5)

- A. Floor
    - 1. Commercial type
    - 2. Kelly float with grinder head
    - 3. Trowel machine with grinder head
- B. Wall
    - 1. Electric auto body type
    - 2. Vibrator type
    - 3. Electric flexible hose type
- C. Ceiling
- D. Edge and base

X. Types of jobs where power grinders are used

- A. Concrete floor--Floor grinder
- B. Rough place on wall--Wall grinder
- C. Concrete projection on ceiling--Ceiling grinder
- D. Edge of floor--Edge and base grinder

XI. Types of sprayers (Transparency 6)

- A. Hand
- B. Electric
- C. Gas

XII. Purpose of a power sprayer--To spray on curing agents, hardeners, and monomolecular films

INFORMATION SHEET

XIII. Types of power hammers (Transparency 7)

- A. Electric
- B. Air
  - 1. Chipping
  - 2. Scaler
  - 3. Heavy duty

XIV. Purposes of a power hammer

- A. To break out concrete
- B. To chip off high or rough places
- C. To bushhammer for a decorative surface

XV. Types of concrete saws (Transparency 8)

- A. Portable electric
- B. Portable gas
- C. Heavy duty floor type

XVI. Purposes of concrete saws

- A. To cut out sections
- B. To saw control joints
- C. To saw joints for decoration

XVII. Miscellaneous power equipment (Transparencies 9, 10, and 11)

- A. Curb and gutter machine
- B. Sandblasting equipment
- C. Shotcrete equipment
- D. Slabjacking process
- E. Vibra-tamp bullfloat
- F. Vibra-tamp

INFORMATION SHEET

XVIII. Related tools and equipment (Transparencies 12-17)

- A. Concrete batch plant and transit mix concrete truck
- B. Mobile concrete plant
- C. Open top agitating concrete truck
- D. Open top nonagitating concrete truck
- E. Concrete pump
- F. Crane and bucket
- G. Material handling tower hoist
- H. Swedish crane
- I. Cableway
- J. Conveyor
- K. Power buggy
- L. Hand buggy
- M. Wheelbarrow
- N. Concrete hopper
- O. Concrete chute
- P. Electric vibrator
    - 1. Lightweight
    - 2. Heavy duty
- Q. Swinging scaffold
- R. Stationary scaffold
- S. Core drill
- T. Tremie
- U. Scabbler

INFORMATION SHEET

XIX. Basic rules concerning care of power tools

A. Keep tools clean and in good working order

B. Follow manufacturer's maintenance procedures before operating equipment

C. Clean all spraying equipment after each specific job

D. Change trowel blades when they become ragged

XX. Basic rules concerning safe use of power tools

A. Do not attempt to operate equipment before getting instructions

B. Do not leave equipment in operation unattended

C. Keep a firm hold on kelly float and troweling machines while in operation

D. Wear safety goggles when operating or working around cutting and chipping equipment

E. Keep feet and fingers away from blades and moving parts when equipment is in operation

F. Check proper ventilation before operating gas powered equipment indoors

G. Lift heavy objects with your legs and not your back

H. Do not attempt to carry on a conversation while operating power tools

I. Do not stand in water while using electric tools

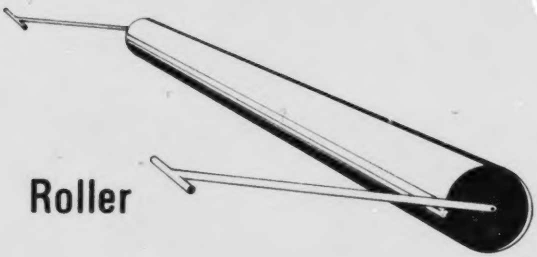
J. Check to see that all electric tools are grounded before using them

K. Keep fire extinguishers handy when filling and/or operating gasoline powered equipment

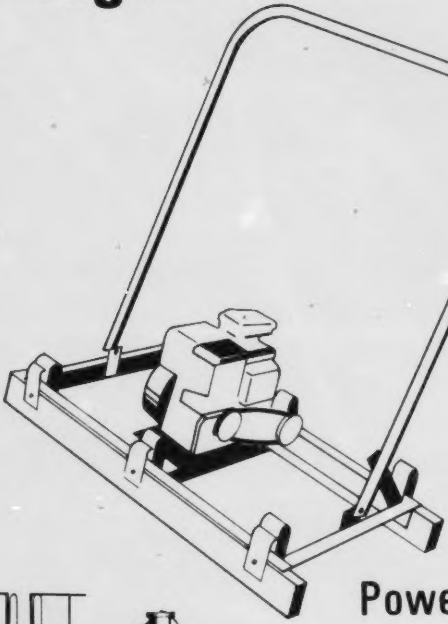
(NOTE: OSHA requires that tools be turned off prior to filling.)

L. Make sure that all equipment is turned off or disconnected before performing maintenance

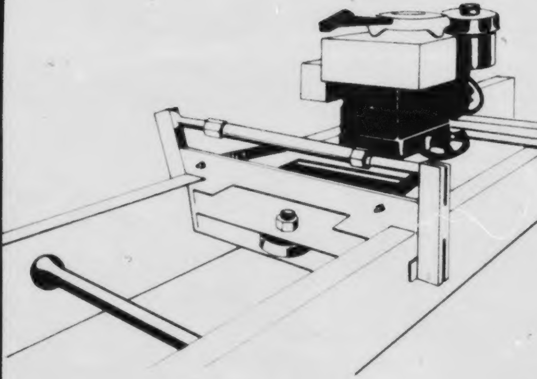
Types of Straightedges



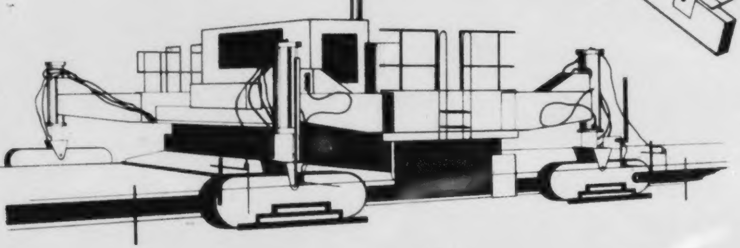
Roller



Power

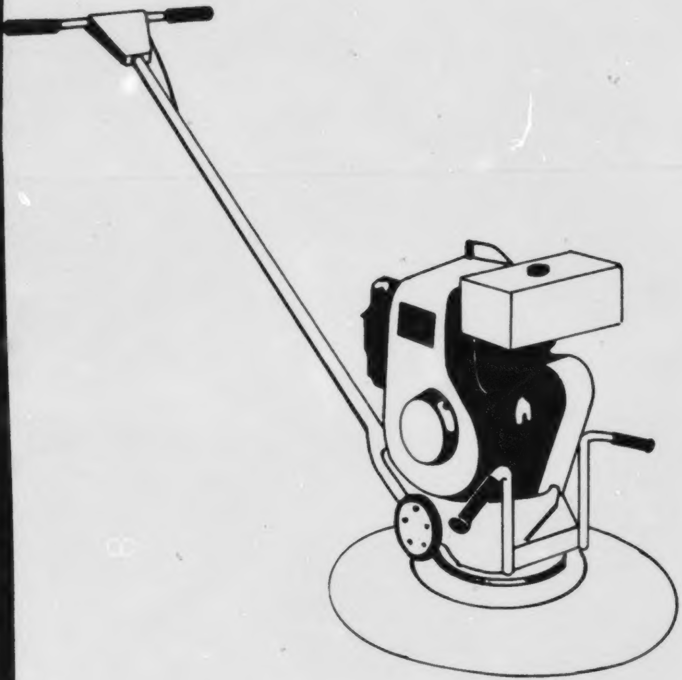


Vibrating

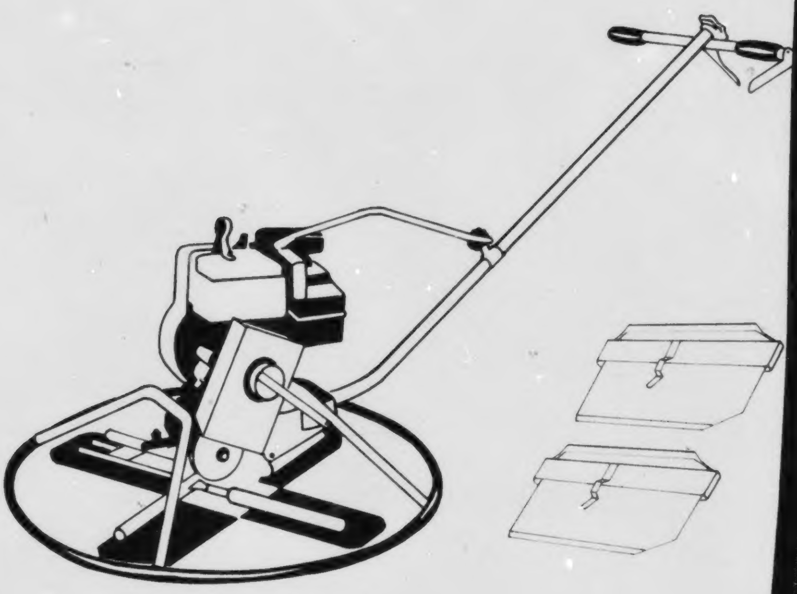


Slip Form Paver

Types of Power Floats

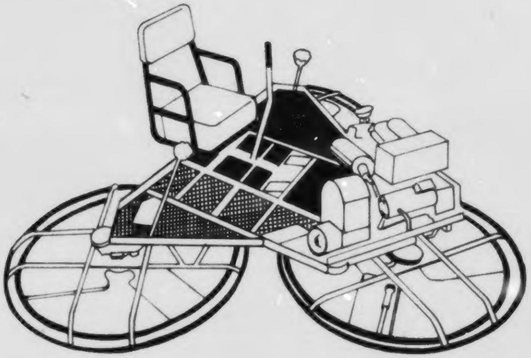


Kelly Float

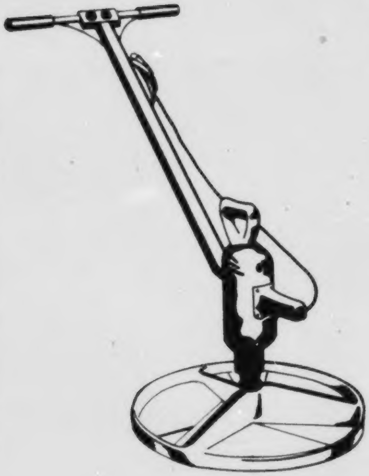


Trowel Machine with Float Blades

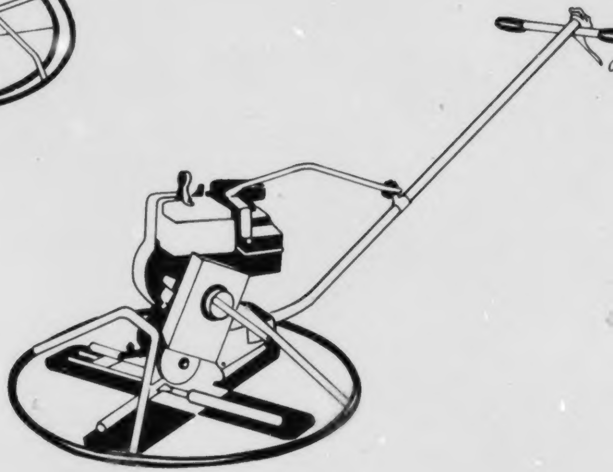
Types of Power Troweling Machines



Riding Trowel

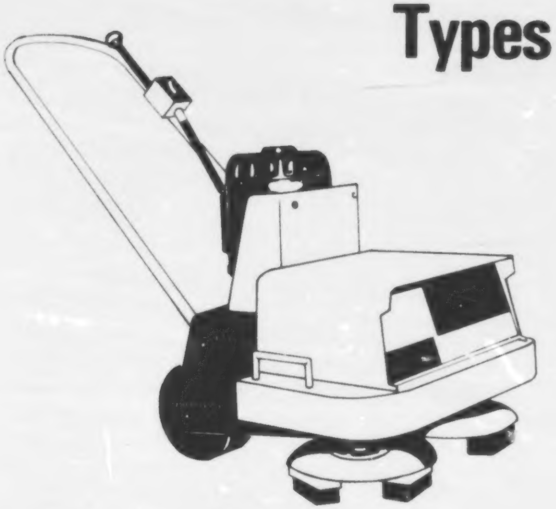


Pony Trowel

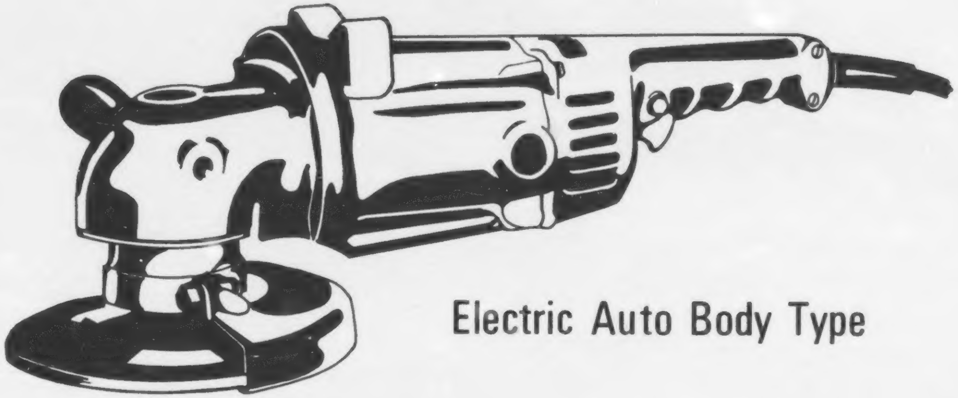


Trowel Machine

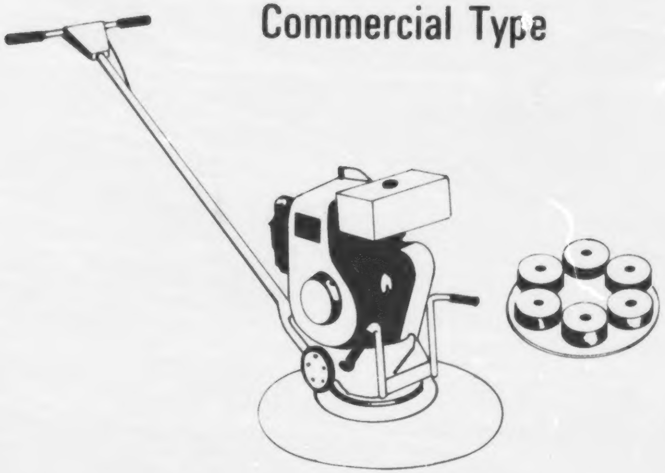
Types of Power Grinders



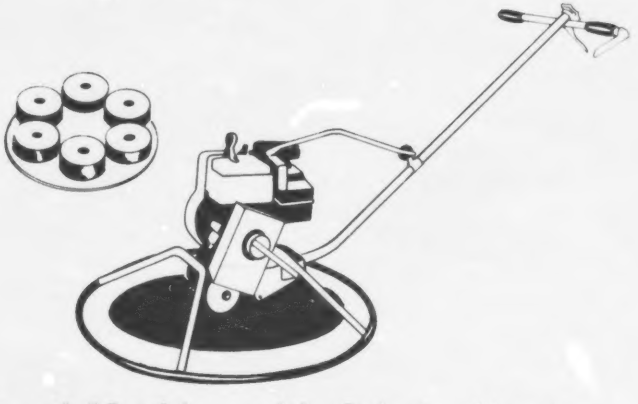
Commercial Type



Electric Auto Body Type



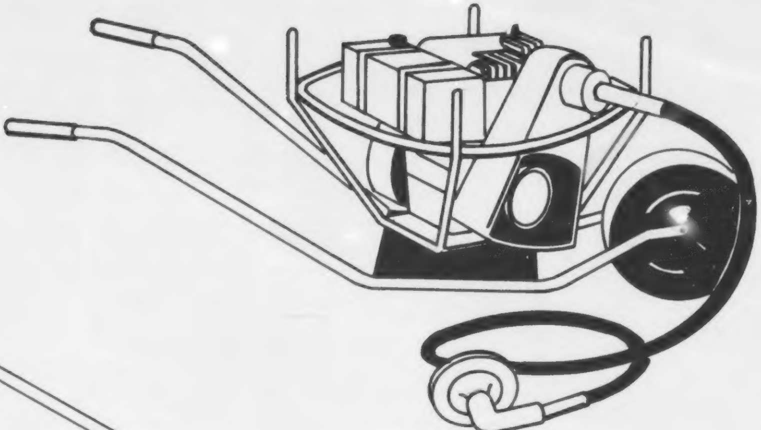
Kelly Float with Grinder Head



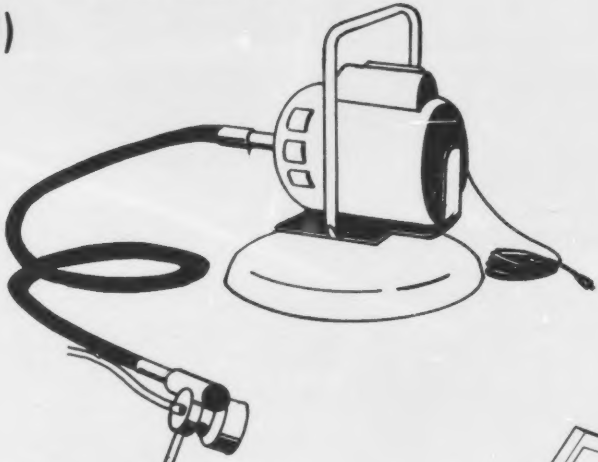
Trowel Machine with Grinder Head

Types of Power Grinders

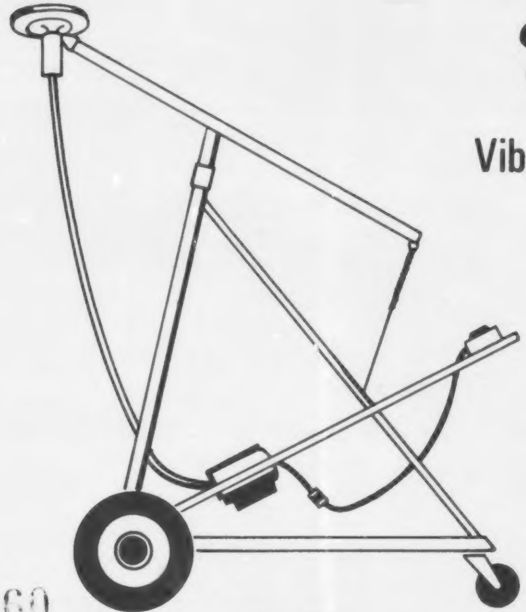
(Continued)



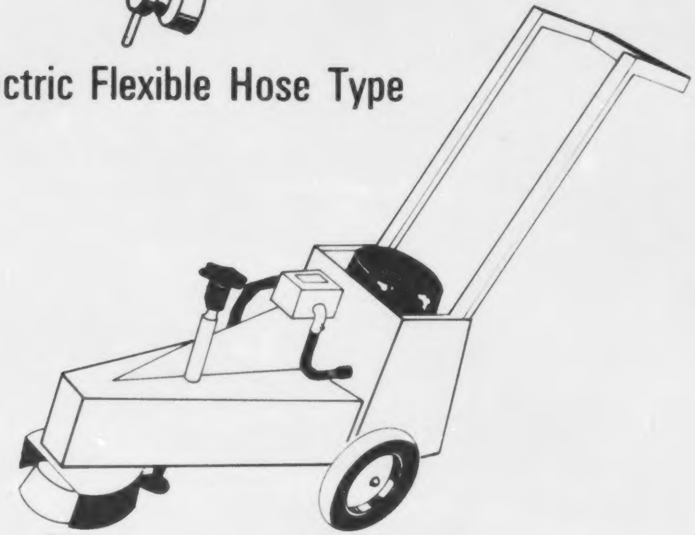
Vibrator Type



Electric Flexible Hose Type

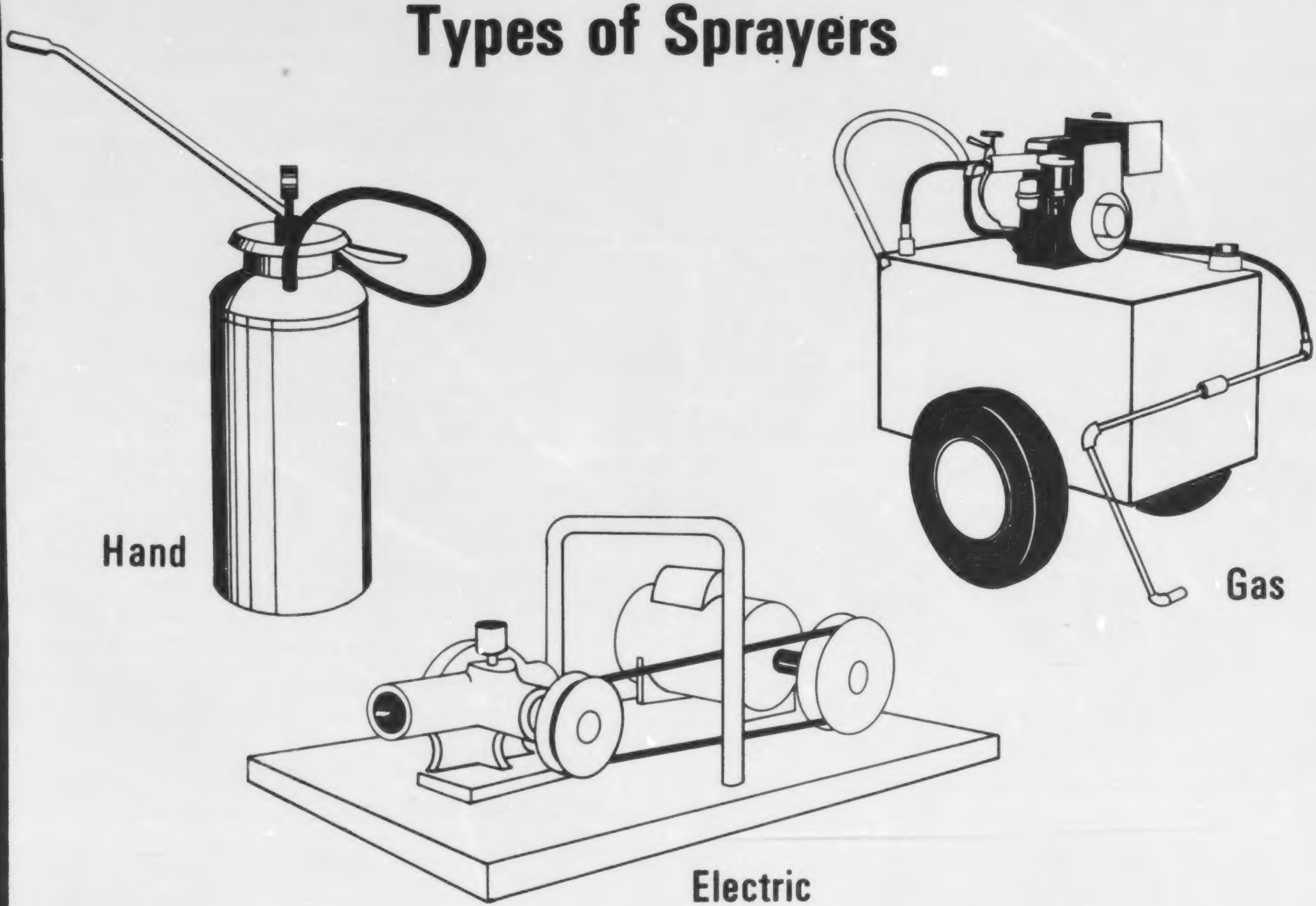


Ceiling



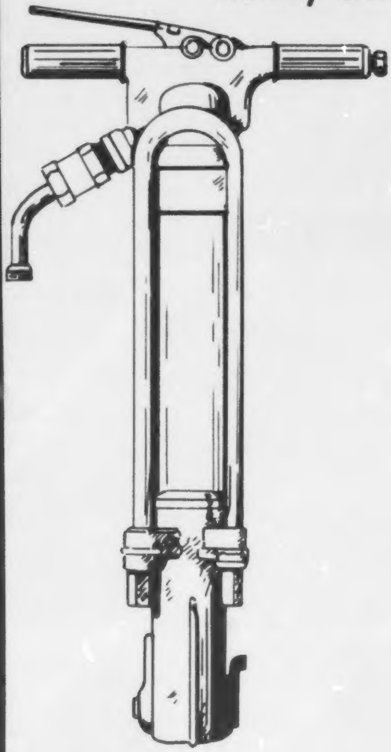
Edge and Base

Types of Sprayers

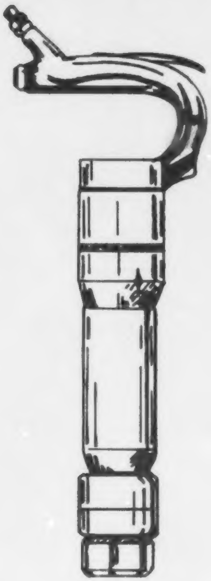

Hand
Gas
Electric

Types of Power Hammers

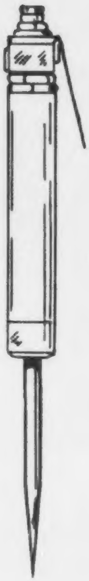
Heavy Duty Hammer



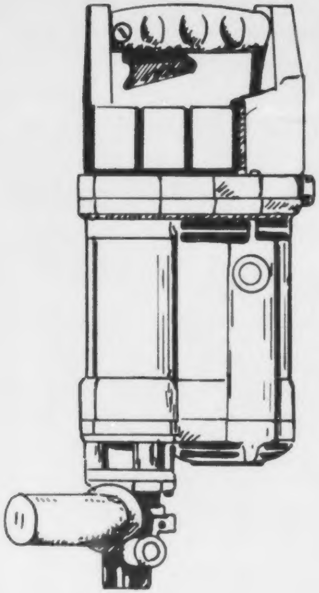
Chipping Hammer



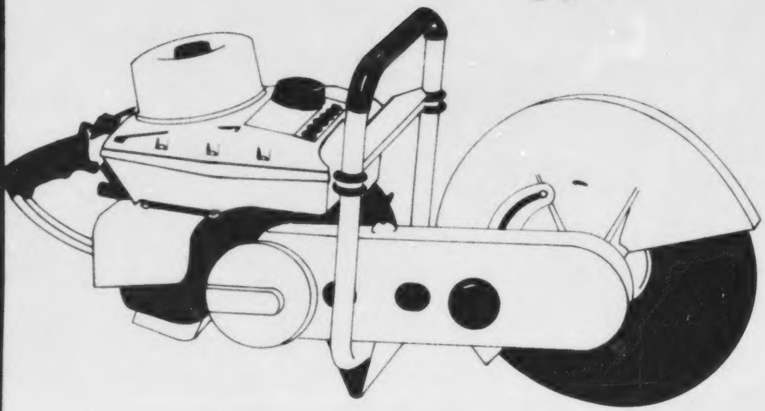
Scaler



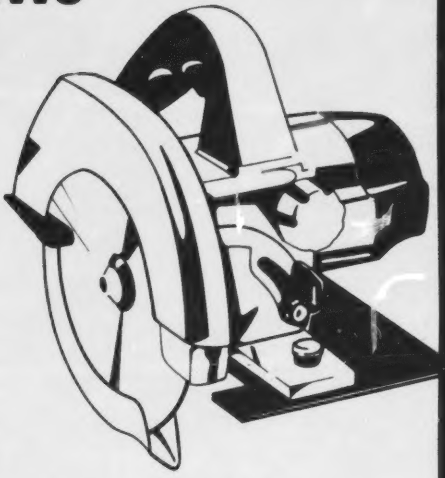
Electric Hammer



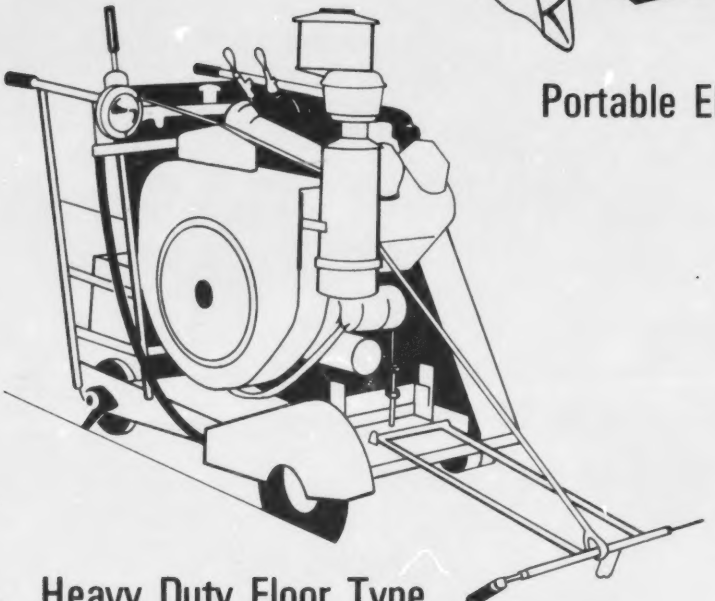
Types of Concrete Saws



Portable Gas

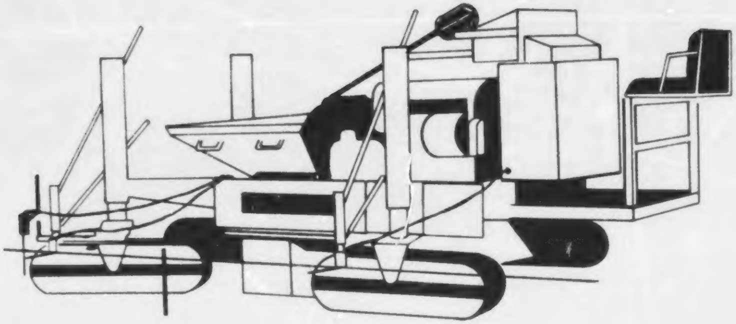


Portable Electric

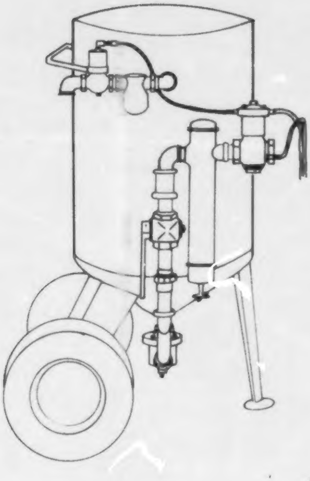


Heavy Duty Floor Type

Miscellaneous Power Equipment



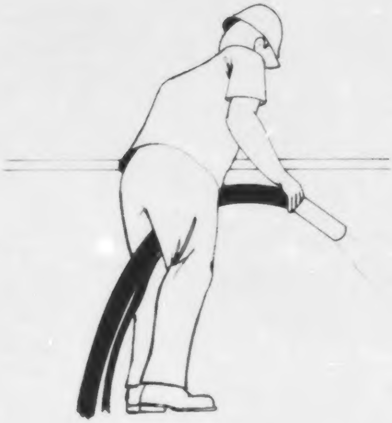
Curb and Gutter Machine

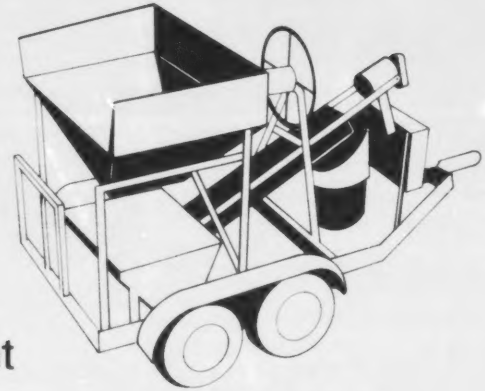


Sandblasting Equipment

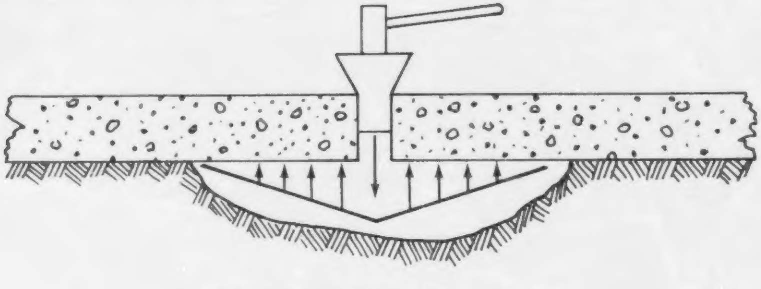
Miscellaneous Power Equipment

(Continued)





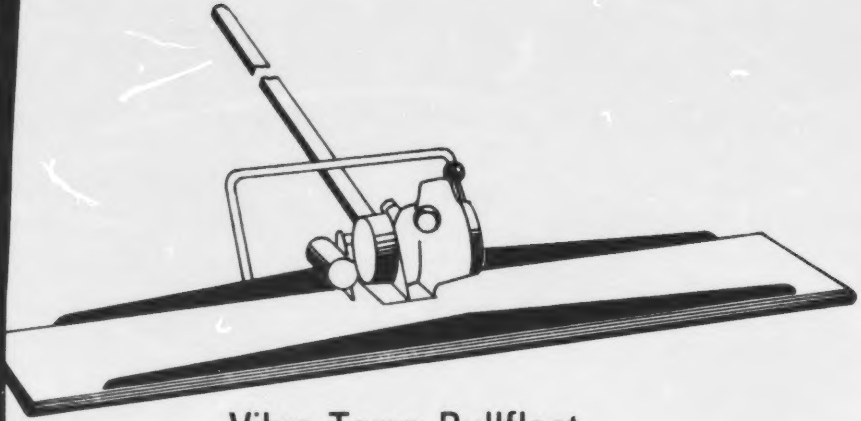
Shotcrete Equipment



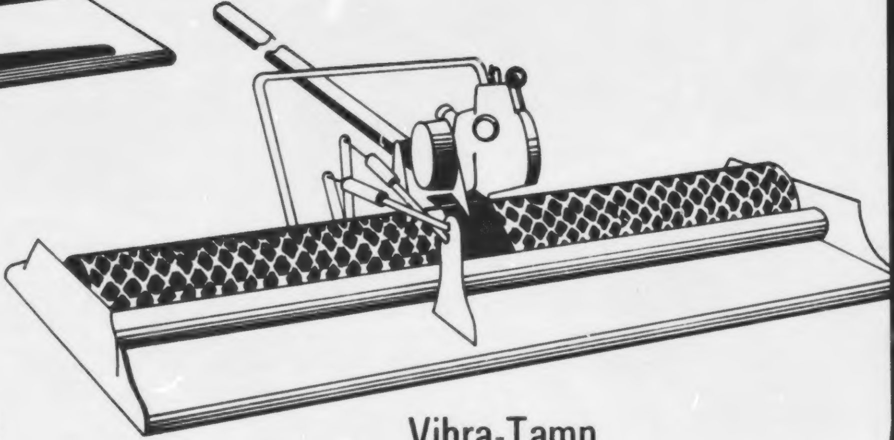
Slabjacking Process

Miscellaneous Power Equipment

(Continued)

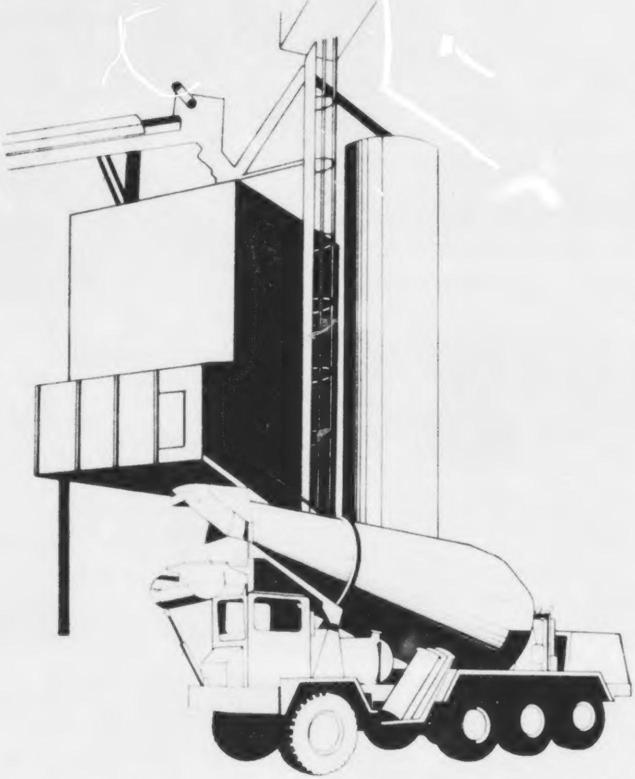


Vibra-Tamp Bullfloat

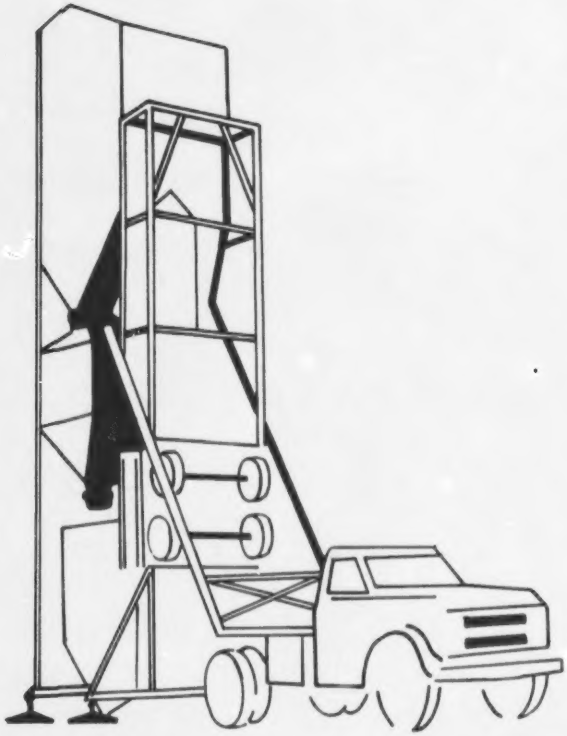


Vibra-Tamp

Related Tools and Equipment



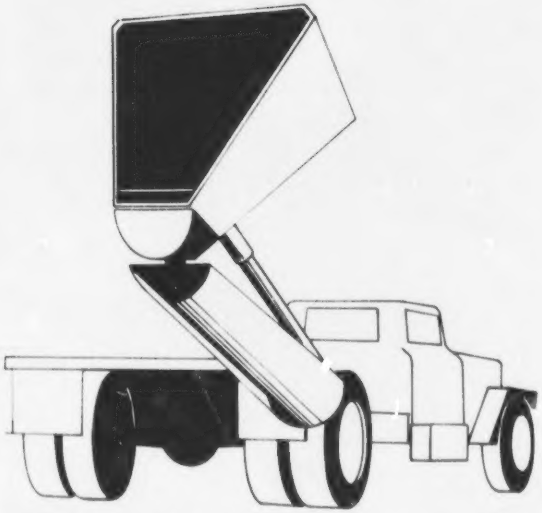
Concrete Batch Plant and
Transit Mix Concrete Truck



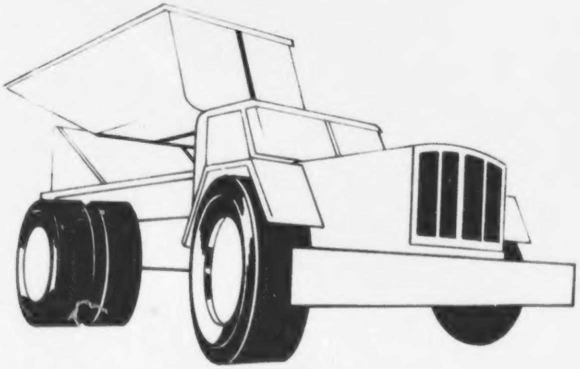
Mobile Concrete Plant

Related Tools and Equipment

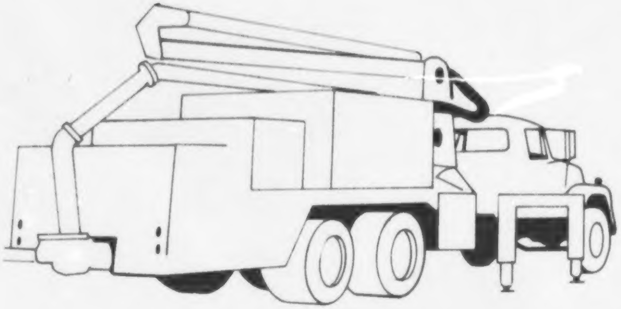
(Continued)



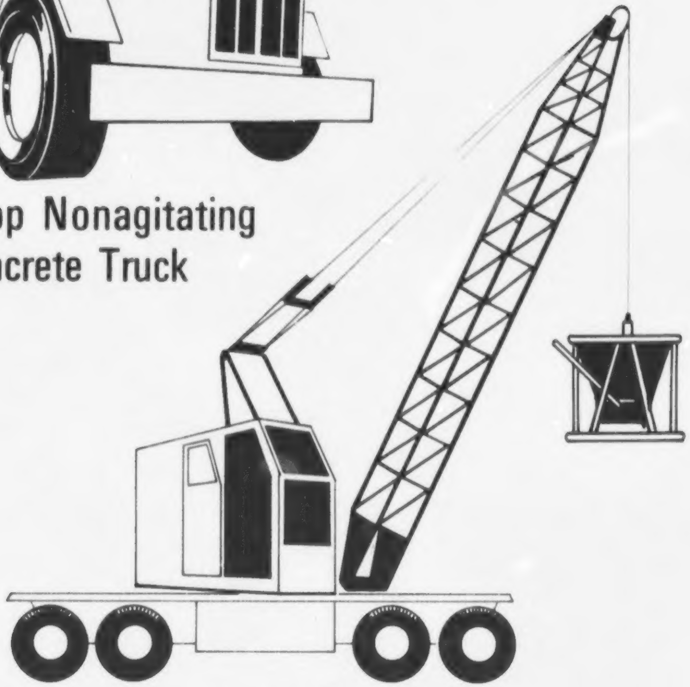
Open Top Agitating Concrete Truck



Open Top Nonagitating Concrete Truck



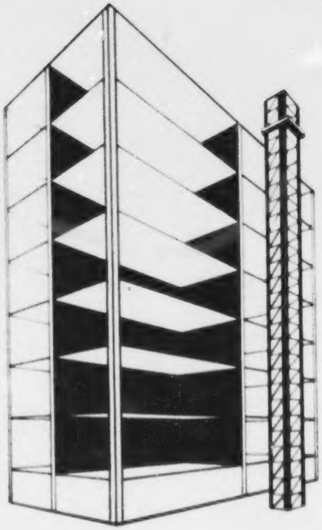
Concrete Pump



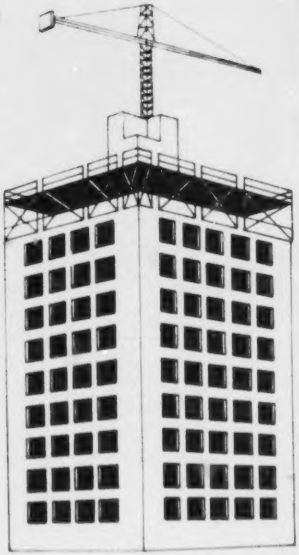
Crane and Bucket

Related Tools and Equipment

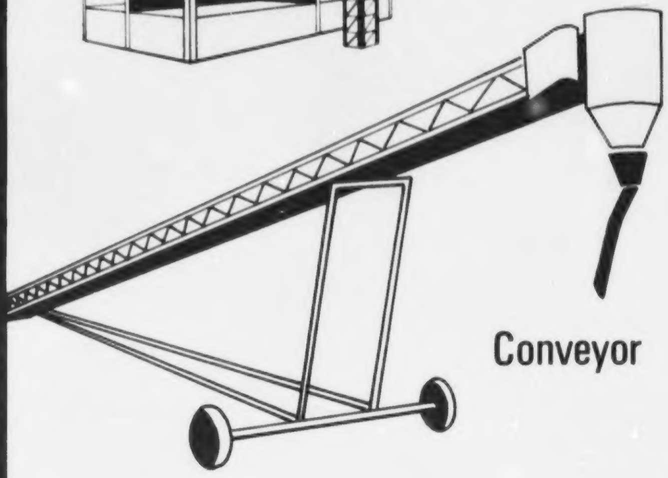
(Continued)



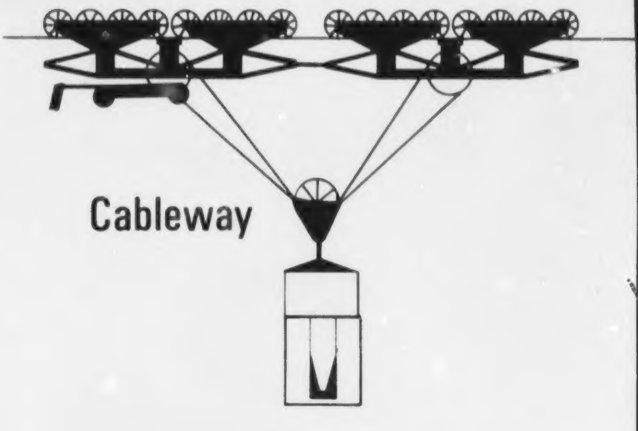
Material Handling Tower Hoist



Swedish Crane



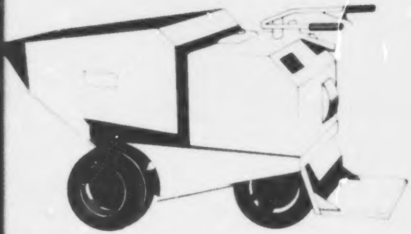
Conveyor



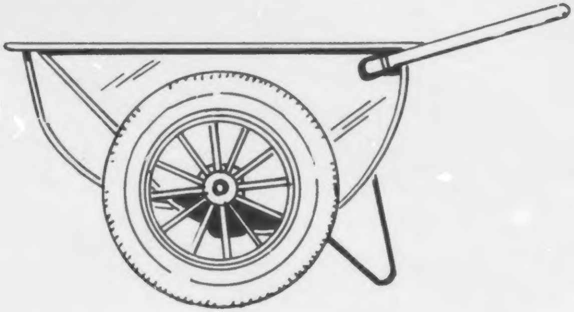
Cableway

Related Tools and Equipment

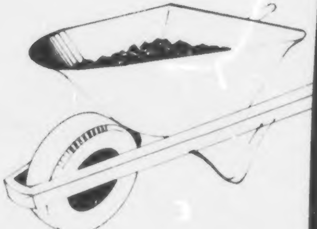
(Continued)



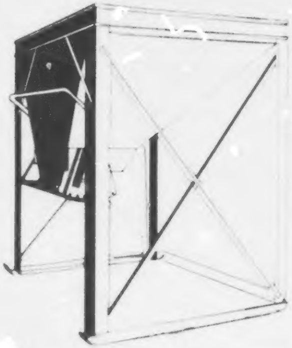
Power Buggy



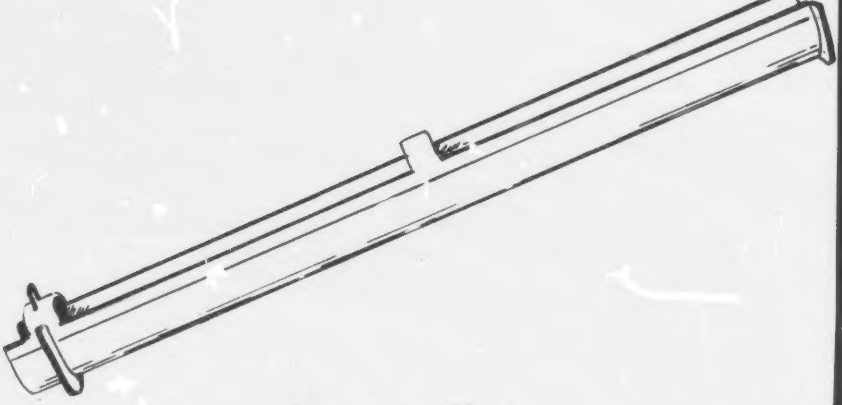
Hand Buggy



Wheelbarrow



Concrete Hopper

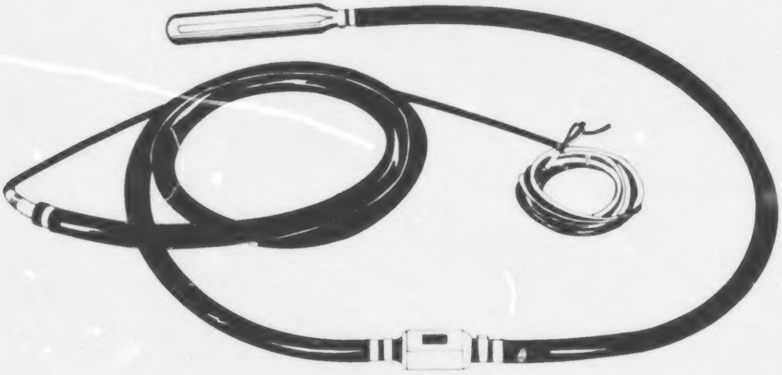


Concrete Chute

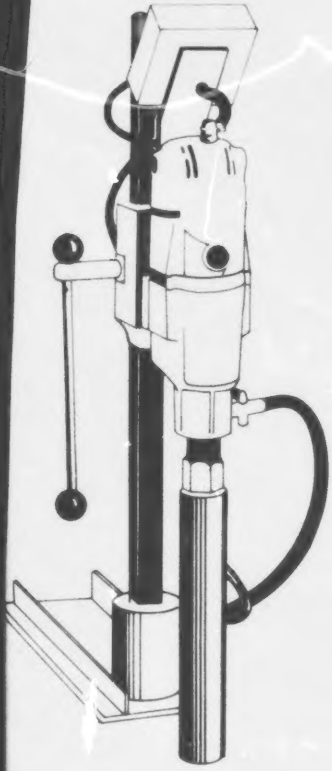
272

Related Tools and Equipment

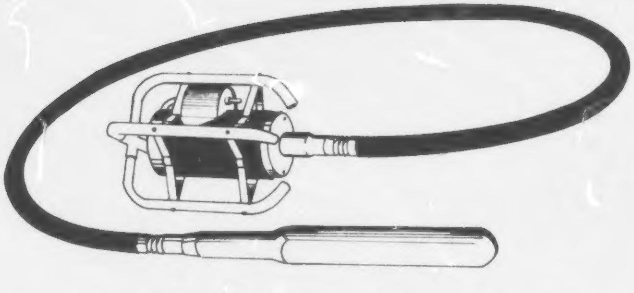
(Continued)



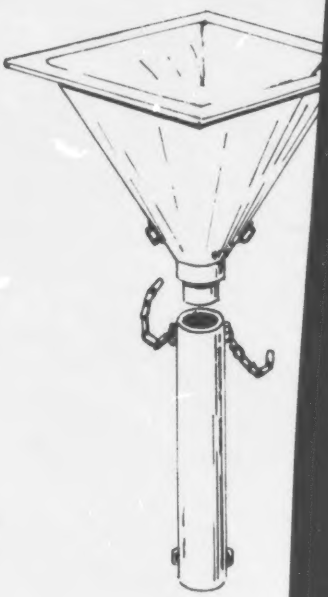
Heavy Duty Electric Vibrator



Core Drill



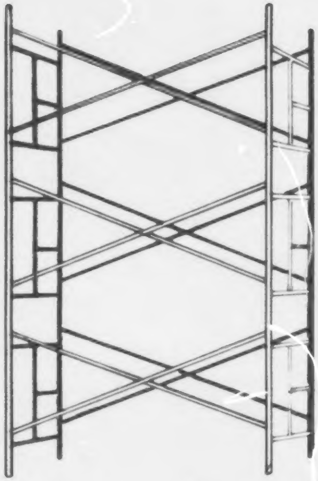
Lightweight Electric Vibrator



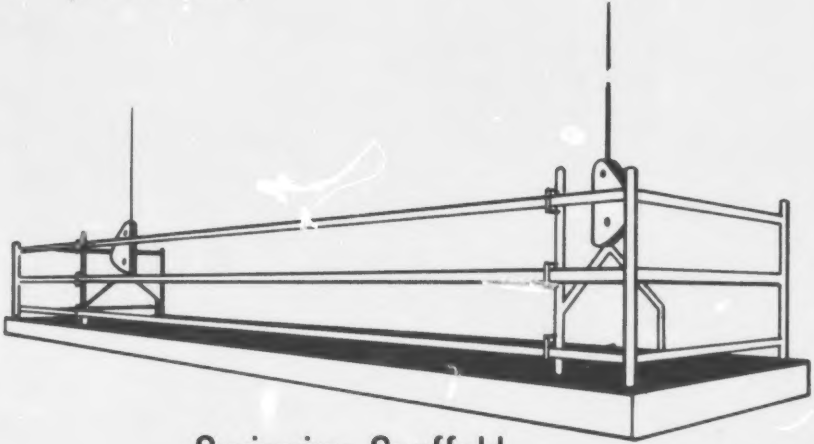
Tremie

Related Tools and Equipment

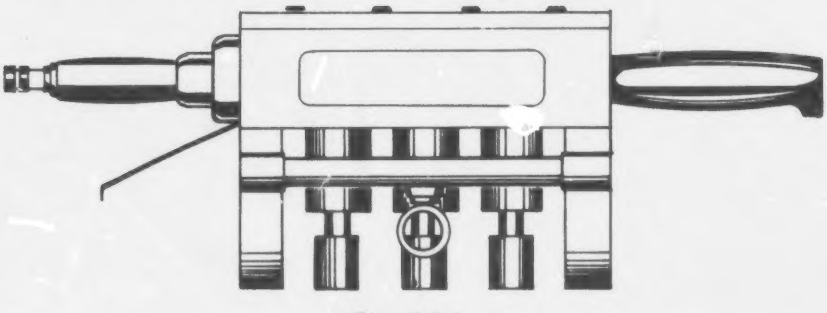
(Continued)



Stationary Scaffold



Swinging Scaffold



Scabbler

POWER TOOLS
UNIT II

TEST

1. Match the terms on the right to the correct definitions.

______a. Term used to designate pneumatically applied concrete; process used to apply cement mixture by compressed air

______b. Process used to remove surface film and fracture surface aggregate to produce a textured and colorful surface

______c. Tool used to compact and float regular concrete and special types of toppings

______d. Process used to cut off the surface of concrete

______e. Joint cut strictly for looks or decorative purposes

______f. Machine with three trowels in one unit; controlled with foot pedals and stick by the operator

______g. Process of pumping grout under a slab to raise it back to its proper grade

______h. Joint cut in concrete to form a plane of weakness where a crack will occur

______i. Tool devised to grind ceilings; mounted on wheels for easy movement

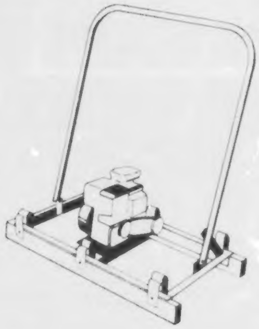
______j. Power tool used to cut off humps on slabs and to disburse excess concrete into low areas, leaving an evenly tamped and level surface

______k. Tool operated by a gas type vibrator; devised to run at slow speed for wet grinding

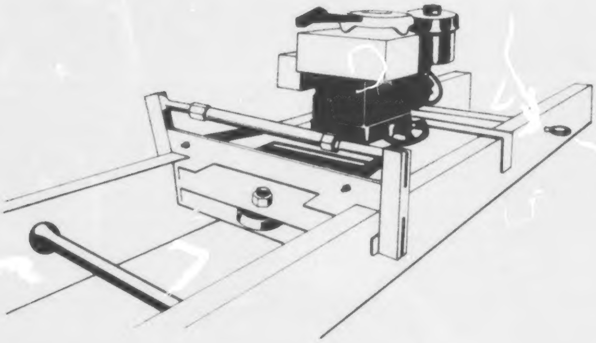
______l. Compound sprayed on fresh concrete to reduce rapid evaporation

1. Kelly float
2. Riding trowel
3. Ceiling grinder
4. Vibrator type grinder
5. Sandblasting
6. Shotcrete
7. Bushhammer
8. Vibra-tamp
9. Control joint
10. Decorative joint
11. Slabjacking
12. Monomolecular film

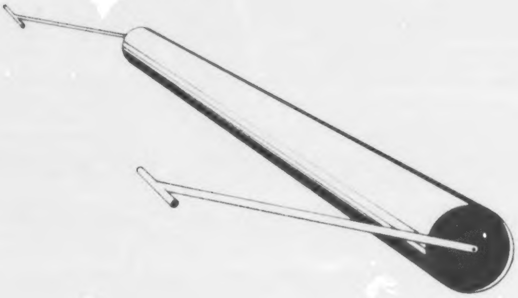
2. Identify four types of straightedges by filling in the blanks with the appropriate names.



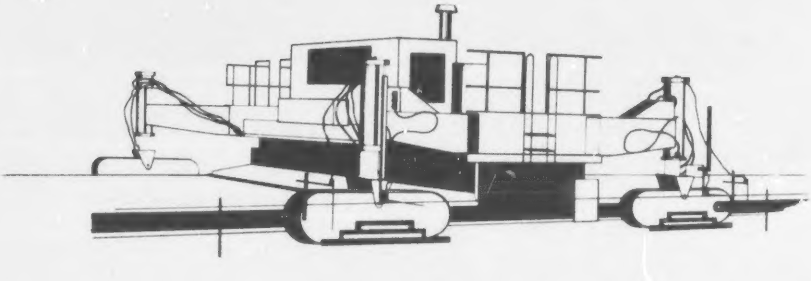
a.______________________________



b.______________________________



c.______________________________________



d.______________________________________

3. State the purpose of a straightedge.

4. List the types of jobs where straightedges are used.

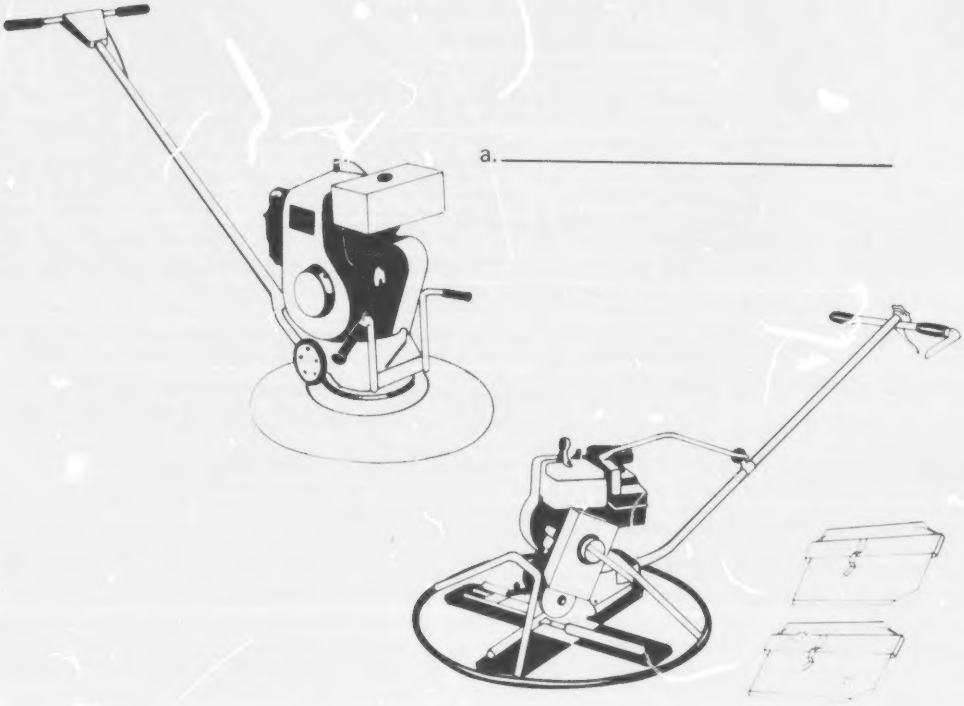
   a.

   b.

   c.

   d.

5. Identify the following types of power floats.



a. ______________________

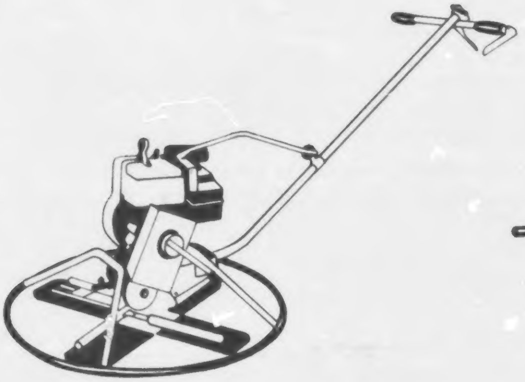
b. ______________________

6. List the types of jobs where power floats are used.

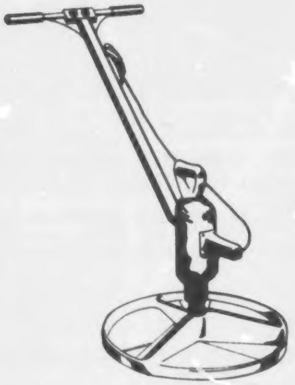
   a.

   b.

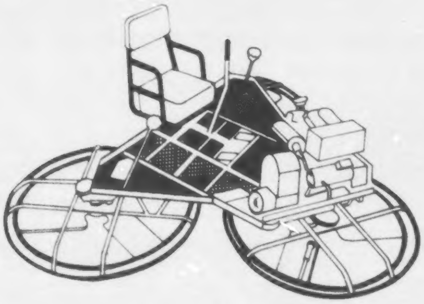
7. Identify the following types of power troweling machines.



a.______________________________



b.______________________________

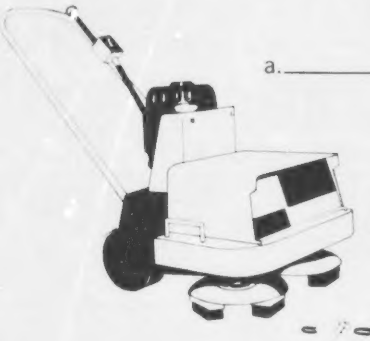


c.______________________________

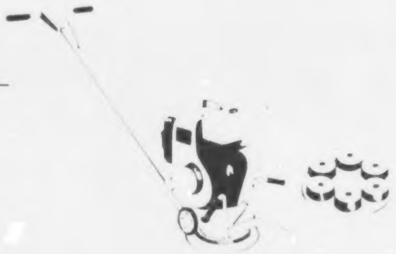
8 Match the types of power troweling machines on the right to the specific jobs. Place the correct number or numbers in the blanks on the left.

_____a.	Regular floor slab	1.	Trowel machine
_____b.	Very large commercial slab work	2.	Pony trowel
_____c.	Very small floor slab	3.	Riding trowel

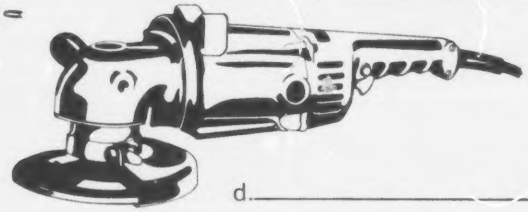
9. Identify the following types of power grinders.



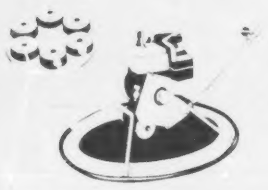
a.______________________________



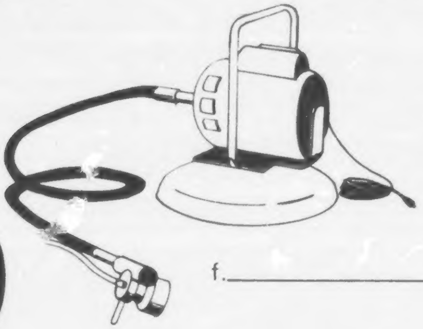
b.______________________________



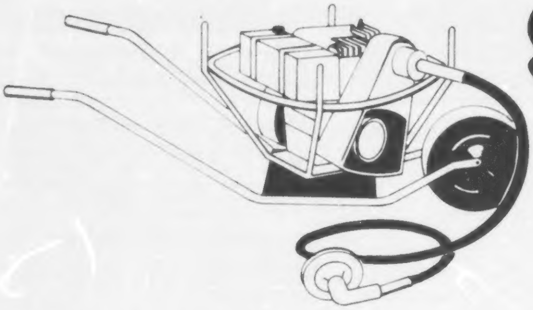
d.______________________________



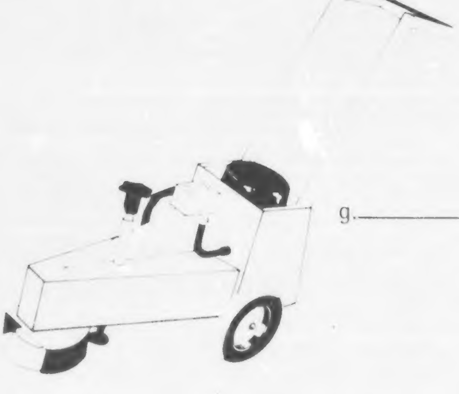
c.______________________________



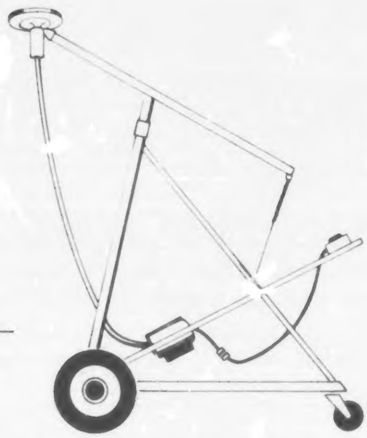
f.______________________________



e.______________________________



g.______________________________



h.______________________________

10. Match the types of power grinders on the right to the specific jobs on the left. Place the correct number in the blank.

_____a. Rough place on wall

_____b. Concrete projection on ceiling

_____c. Edge of floor

_____d. Concrete floor

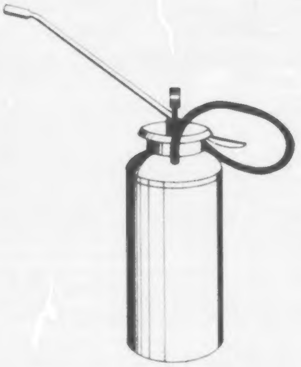
1. Edge and base

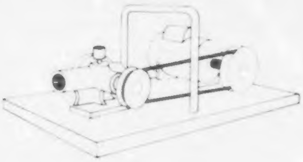
2. Floor

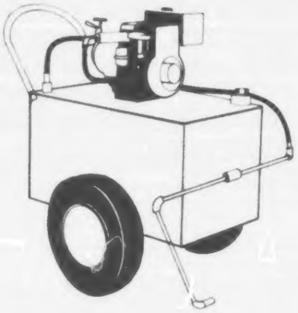
3. Wall

4. Ceiling

11. Identify the following types of sprayers.



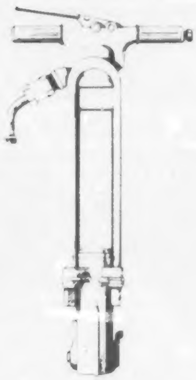




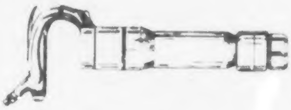
a.____________________ b.____________________ c.____________________

12. State the purpose of a power sprayer in concrete work.

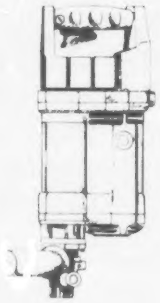
13. Identify the following types of hammers.



b.____________________



c.____________________



d.____________________

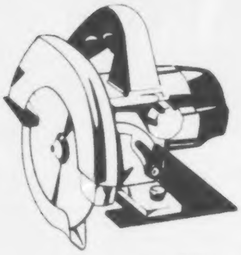
a.____________________

14. State two purposes of a power hammer.

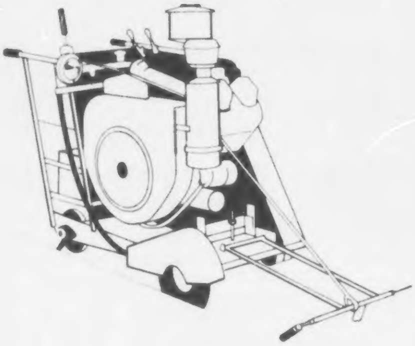
a.

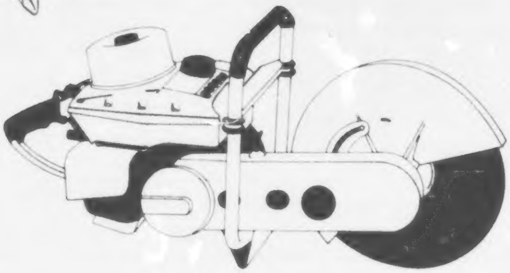
b.

15. Identify the following types of concrete saws.



a. ____________________





c. ____________________

b. ____________________

16. State three purposes of concrete saws.

a.

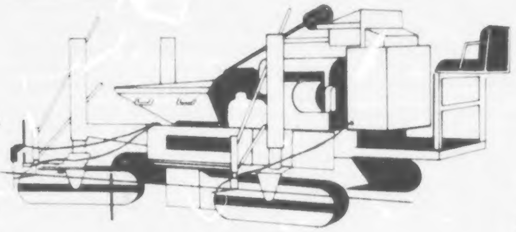
b.

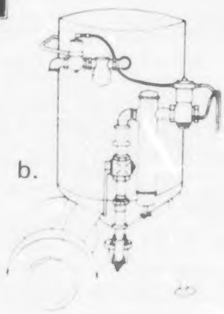
c.

17. Identify the following miscellaneous power tools.

a. ____________

a.



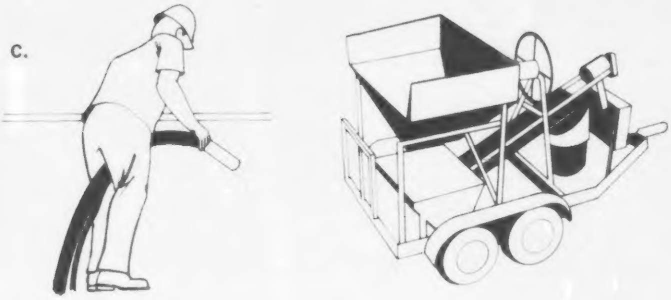


b.

b. ____________

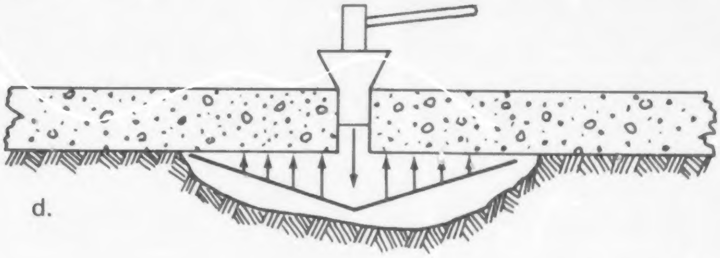
c.____________

c.



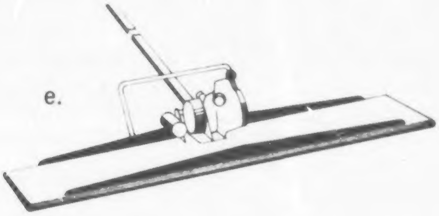
d.____________

d.



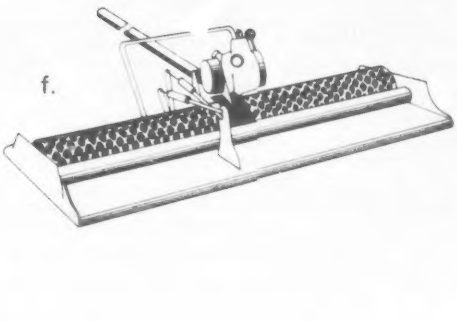
e.____________

e.



f.____________

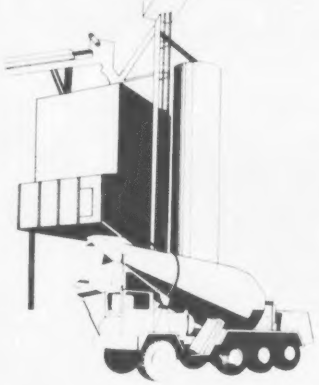
f.



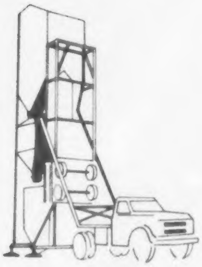
18. Identify the following related tools and equipment by placing the names in the blanks provided.

a.____________

a.

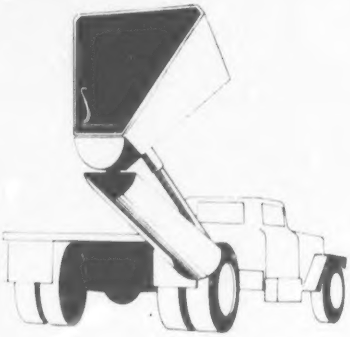


b.____________



b.

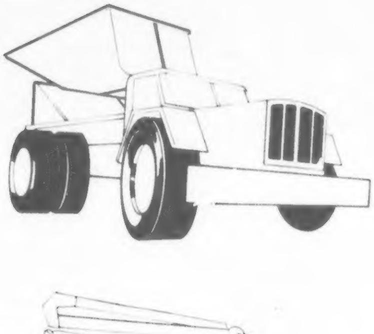
c.



c.____________

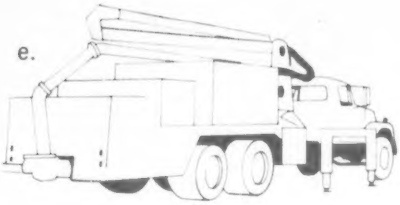
d.

d.____________



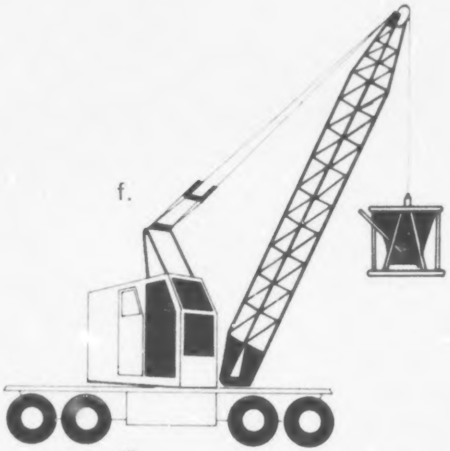
e.____________

e.

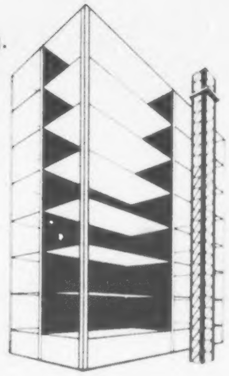


f.______________

f.

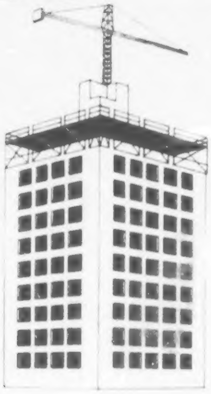


g.



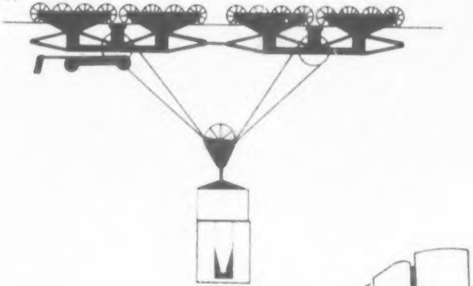
g.______________

h.______________



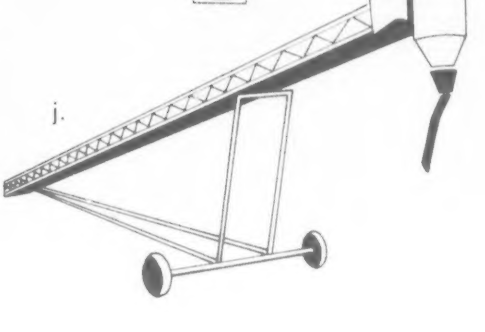
h.

i.



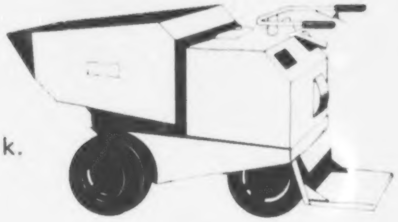
i.______________

j.______________



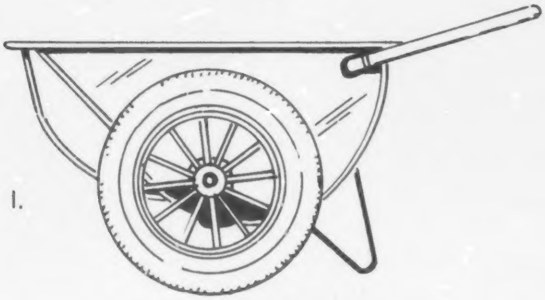
j.

k.____________



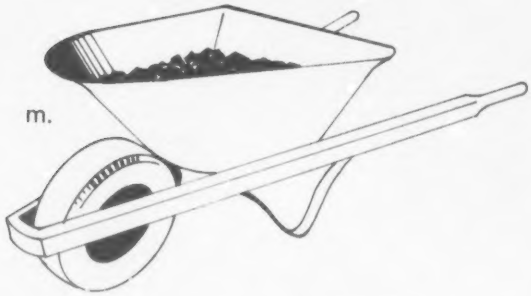
k.

l.____________



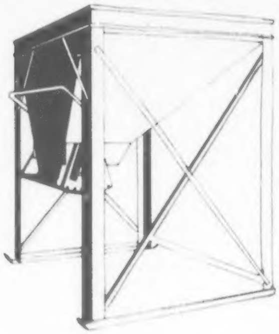
l.

m.____________



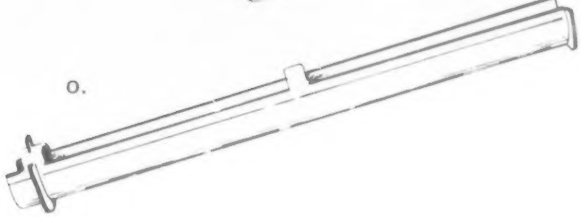
m.

n.____________



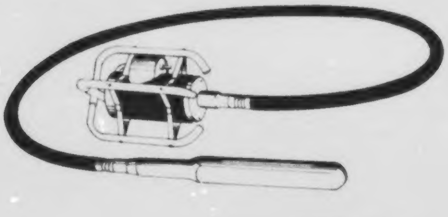
n.

o.____________

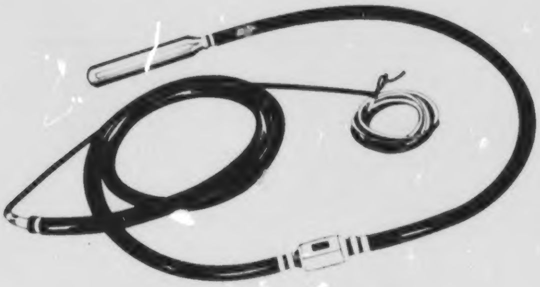


o.

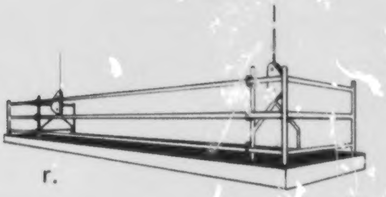
p.____________


p.

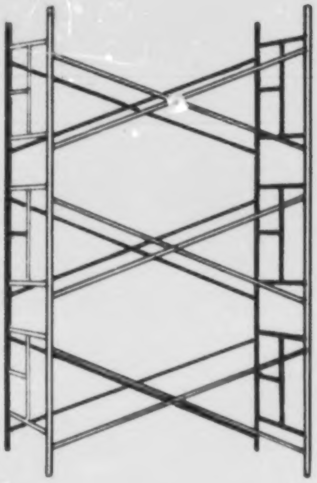
q.____________


q.

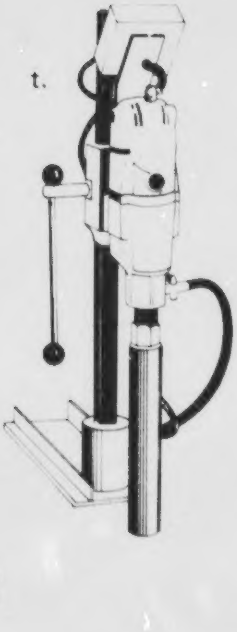
r.____________


r.

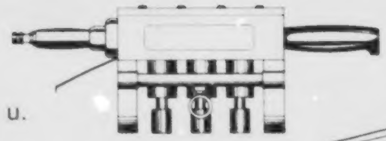
s.____________

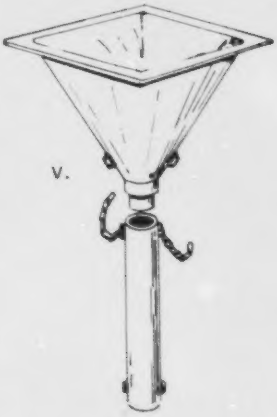

s.

t.____________


t.

u. ____________





v. ____________

19. List four basic rules concerning the care of power tools.

    a.

    b.

    c.

    d.

20. List four basic rules concerning the safe use of power tools.

    a.

    b.

    c.

    d.

POWER TOOLS
UNIT II

ANSWERS TO TEST

1. a. 6
   b. 7
   c. 1
   d. 5
   e. 10
   f. 2
   g. 11
   h. 9
   i. 3
   j. 8
   k. 4
   l. 12
2. a. Power
   b. Vibrating
   c. Roller
   d. Slip form paver
3. To level concrete slabs
4. a. Floor slab
   b. Sidewalk
   c. Pavement
   d. Runway
5. a. Kelly float
   b. Trowel machine with float blades
6. a. Special toppings and color work
   b. Finishing floor slabs

7. a. Trowel machine
   b. Pony trowel
   c. Riding trowel
8. a. 1
   b. 3
   c. 2
9. a. Commercial type
   b. Kelly float with grinder head
   c. Trowel machine with grinder head
   d. Electric auto body type
   e. Vibrator type
   f. Electric flexible hose type
   g. Edge and base
   h. Ceiling
10. a. 3
    b. 4
    c. 1
    d. 2
11. a. Hand
    b. Electric
    c. Gas
12. To spray on curing agents, hardeners, and monomolecular films
13. a. Heavy duty hammer
    b. Scaler
    c. Chipping hammer
    d. Electric hammer

14. Any two of the following are acceptable.
    a. To break out concrete
    b. To chip off high or rough places
    c. To bushhammer for a decorative surface

15. a. Portable electric
    b. Portable gas
    c. Heavy duty floor type

16. a. To saw control joints
    b. To saw decorative joints
    c. To cut out sections

17. a. Curb and gutter machine
    b. Sandblasting equipment
    c. Shotcrete equipment
    d. Slabjacking process
    e. Vibra-tamp bullfloat
    f. Vibra-tamp

18. a. Concrete batch plant and transit mix concrete truck
    b. Mobile concrete plant
    c. Open top agitating concrete truck
    d. Open top nonagitating concrete truck
    e. Concrete pump
    f. Crane and bucket
    g. Material handling tower hoist
    h. Swedish crane
    i. Cableway
    j. Conveyor
    k. Power buggy

l. Hand buggy

m. Wheelbarrow

n. Concrete hopper

o. Concrete chute

p. Lightweight electric vibrator

q. Heavy duty electric vibrator

r. Swinging scaffold

s. Stationary scaffold

t. Core drill

u. Scabbler

v. Tremie

19. a. Keep tools clean and in good working order

b. Follow manufacturer's maintenance procedures before operating equipment

c. Clean all spraying equipment after each specific job

d. Change trowel blades when they become ragged

20. Any four of the following are acceptable.

a. Do not attempt to operate equipment before getting instructions

b. Do not leave equipment in operation unattended

c. Keep a firm hold on kelly float and troweling machines while in operation

d. Wear safety goggles when operating or working around cutting and chipping equipment

e. Keep fingers and feet away from blades and moving parts when equipment is in operation

f. Check proper ventilation before operating gas powered equipment indoors

g. Lift heavy objects with your legs and not your back

h. Do not attempt to carry on a conversation while operating power tools

i. Do not stand in water while using electric tools

j. Check to see that all electric tools are properly grounded before using them

k. Keep fire extinguishers handy when filling and/or operating gasoline powered equipment

l. Make sure that all equipment is turned off or disconnected before performing maintenance

FORMING TOOLS
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify forming tools and be able to match the tools to their specific uses. He should be able to demonstrate the ability to use each tool safely and correctly. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with concrete form setting to the correct definition.
2. Identify three types of hammers.
3. Match the type of hammer to a specific use.
4. Identify four types of leveling instruments.
5. Match the type of leveling instrument to a specific use.
6. Identify three types of measuring instruments.
7. Match the type of measuring instrument to a specific use.
8. Identify seven miscellaneous tools.
9. List four basic rules concerning the care of forming tools.
10. List six basic rules concerning the safe use of forming tools.

FORMING TOOLS
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheets.

   F. Show examples of tools.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheets.

   C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheets

   C. Transparency masters

      1. TM 1--Types of Hammers

      2. TM 2--Types of Leveling Instruments

      3. TM 3--Types of Measuring Instruments

      4. TM 4--Miscellaneous Tools

5. TM 5--Miscellaneous Tools (Continued)

D. Test

E. Answers to test

II. References:

A. Goldblatt Tool Company. *Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1974.

B. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

FORMING TOOLS
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Sledge hammer--Heavy hammer used for driving stakes

      (NOTE: The most commonly used hammer is one weighing ten or twelve pounds.)

   B. Stake--Piece of wood or metal with a point on one end; used to hold forms in place

   C. Grade--Given elevation to which forms are set

   D. String line--String used as a guide in setting forms

   E. Magnetic nail driver--Tool used to drive short concrete nails through expansion and into the wall when setting expansion materials

   F. Expansion material--Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

   G. Utility knife--Tool used for cutting expansion materials

II. Types of hammers (Transparency 1)

   A. Claw hammer

   B. Sledge hammer

   C. Hatchet

III. Types of hammers and their specific uses

   A. Claw hammer

      1. Driving nails

      2. Drawing nails

   B. Sledge hammer--Driving stakes

   C. Hatchet--Sharpening stakes

IV. Types of leveling instruments (Transparency 2)

   A. Builder's

   B. Spirit

INFORMATION SHEET

  C. Torpedo

  D. Line

V. Types of leveling instruments and their specific uses

  A. Builder's

    1. Setting grades

    2. Transferring grades

    3. Checking grades

    4. Checking elevations

  B. Spirit

    1. Setting grades

    2. Transferring grades

    3. Checking grades

  C. Torpedo--Checking grades on very short forms

  D. Line--Checking grades of a dry line

VI. Types of measuring instruments (Transparency 3)

  A. Folding rule

  B. Steel power tape

  C. One hundred foot tape

VII. Types of measuring instruments and their specific uses

  A. Folding rule

    1. Laying out forms

    2. Laying out joints

    3. Checking for square

INFORMATION SHEET

B. Steel power tape
  1. Laying out forms
  2. Laying out joints
  3. Checking for square

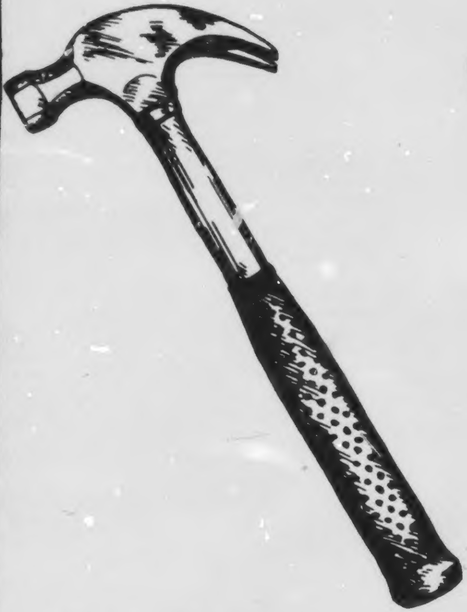
C. One hundred foot tape
  1. Laying out forms
  2. Laying out joints
  3. Checking for square

VIII. Miscellaneous tools (Transparencies 4 and 5)
  A. Handsaw
  B. Framing square
  C. String line (dry line)
  D. Chalk line and reel
  E. Wrecking bar
  F. Magnetic nail driver
  G. Utility knife

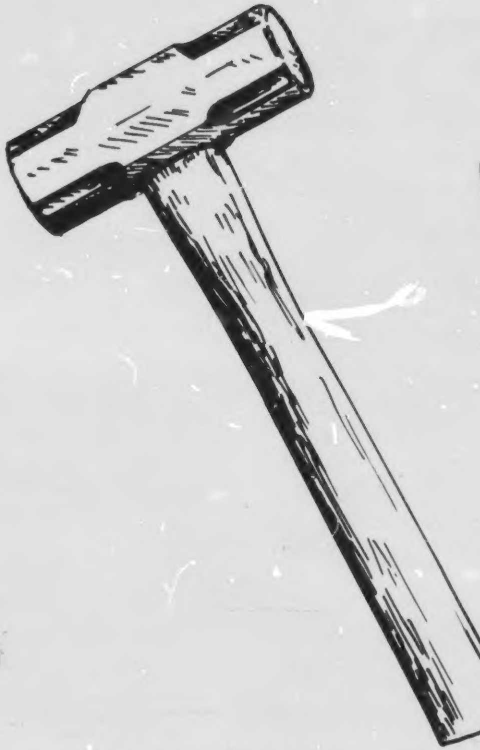
IX. Basic rules concerning the care of forming tools
  A. Keep tools clean and dry
  B. Keep tools sharp and in good working order
  C. Do not carry builder's level over shoulder
  D. Loosen set screws on builder's level when not in use

X. Basic rules concerning the safe use of forming tools
  A. Use the right tool for the right job
  B. Do not use broken tools
  C. Do not throw tools
  D. Be sure tool handles are securely fastened to body of tool
  E. Protect cutting edge of tools when carrying and/or storing
  F. Be sure concrete nails are set tightly into the material before driving them

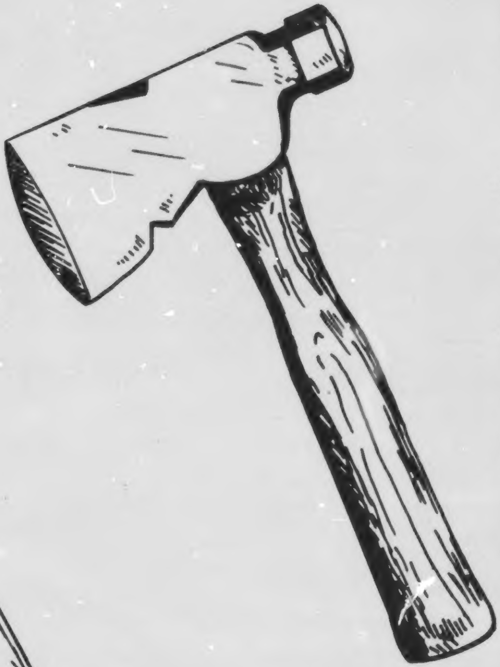
Types of Hammers



Claw Hammer

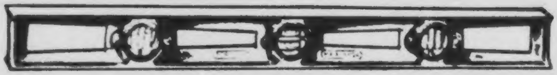


Sledge Hammer

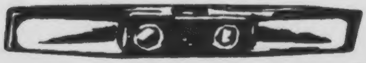


Hatchet

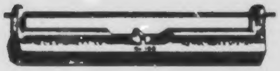
Types of Leveling Instruments



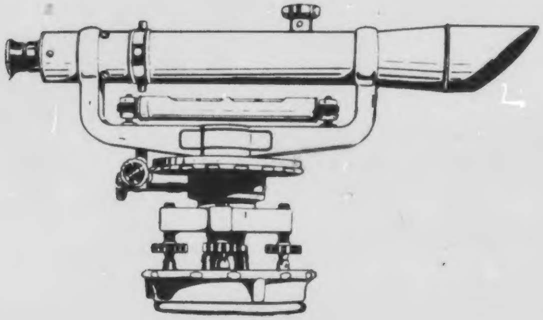
Spirit Level



Torpedo Level

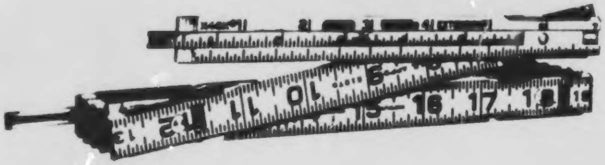


Line Level

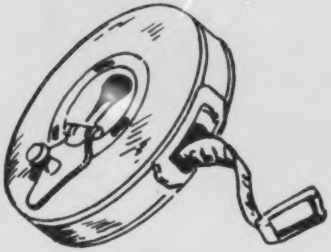


Builder's Level

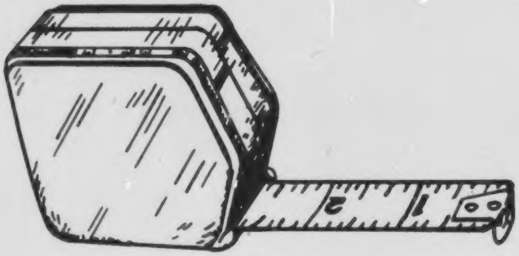
Types of Measuring Instruments



Folding Rule

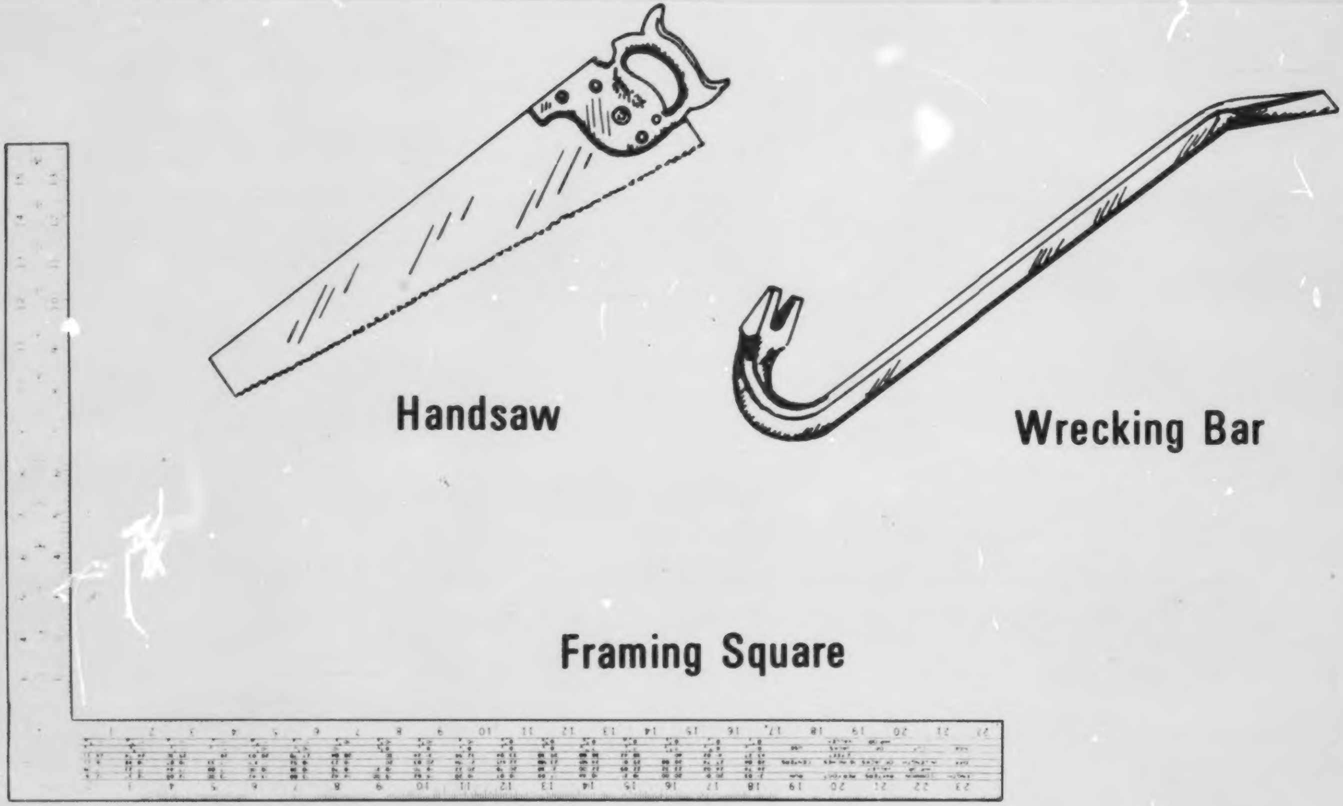


One Hundred
Foot Tape



Steel Power Tape

Miscellaneous Tools



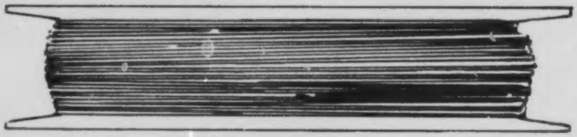
Handsaw

Wrecking Bar

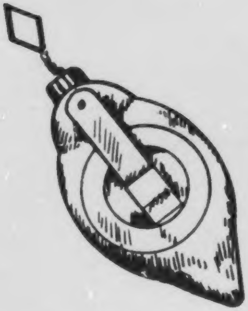
Framing Square

Miscellaneous Tools

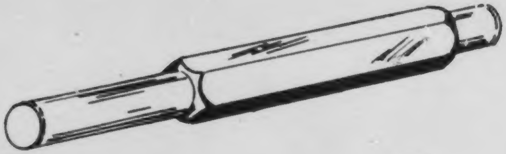
(Continued)



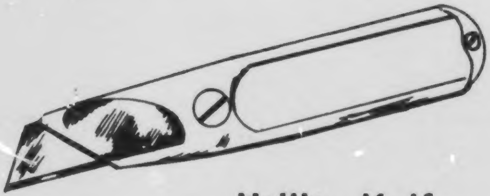
String Line (Dry Line)



Chalk Line and Reel



Magnetic Nail Driver



Utility Knife

FORMING TOOLS
UNIT III

TEST

1. Match the terms on the right to the correct definitions.

_____a. Tool used for cutting expansion materials

_____b. String used as a guide in setting forms

_____c. Heavy hammer used for driving stakes

_____d. Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

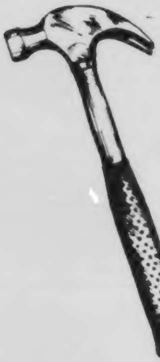
_____e. Given elevation to which forms are set

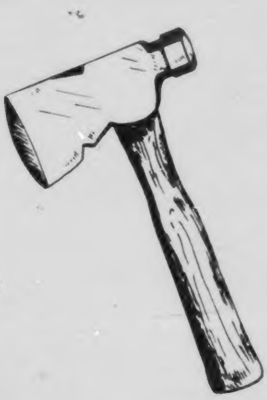
_____f. Piece of wood or metal with a point on one end; used to hold forms in place

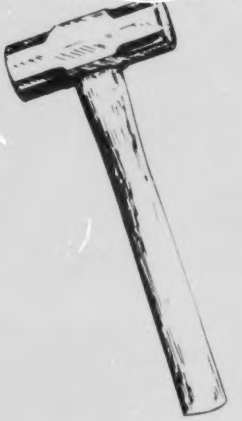
_____g. Tool used to drive short concrete nails through expansion and into the wall when setting expansion materials

1. Sledge hammer
2. Utility knife
3. Stake
4. Grade
5. Expansion material
6. Magnetic nail driver
7. String line

2. Identify three types of hammers.





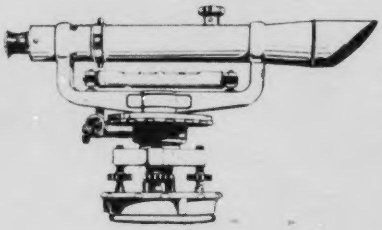


a. ____________________ b. ____________________ c. ____________________

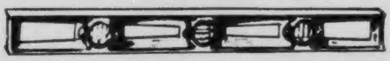
3. Match the type of hammer on the right to a specific use by placing the appropriate number in the blank.

_____ a. Sharpening stakes	1. Claw hammer
_____ b. Driving nails	2. Sledge hammer
_____ c. Driving stakes	3. Hatchet

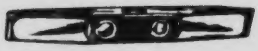
4. Identify four types of leveling instruments.



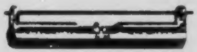
a. ______________________________



b. ______________________________



c. ______________________________

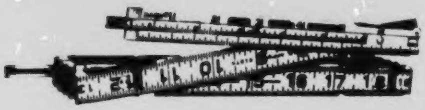


d. ______________________________

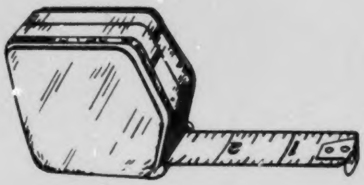
5. Match the type of leveling instrument on the right to the specific use by placing the appropriate number or numbers in the blanks.

_____ a. Checking grades of a dry line	1. Builder's
_____ b. Checking elevations	2. Spirit
_____ c. Transferring grades	3. Torpedo
_____ d. Checking grades on very short forms	4. Line

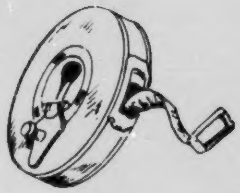
6. Identify the three types of measuring instruments below by writing the correct names in the blanks provided.



a. ______________________



b. ______________________



c. ______________________

7. Match the type of measuring instrument on the right to a specific use by placing the appropriate number or numbers in the blanks.

_____a. Laying out joints

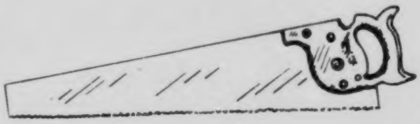
_____b. Checking for square

_____c. Laying out forms

1. Folding rule
2. Steel power tape
3. One hundred foot tape

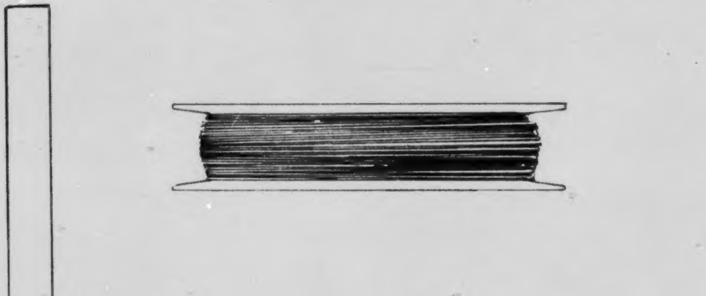
8. Identify the seven miscellaneous tools below by writing the correct names in the corresponding blanks.

a. ____________

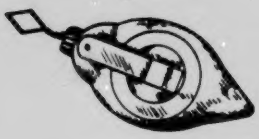


b. ____________

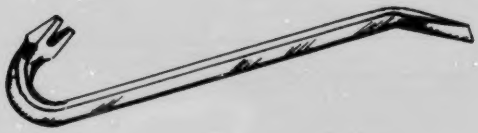
c. ____________



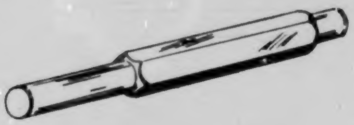
d.____________



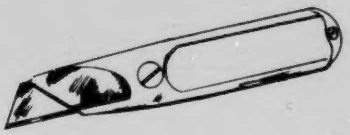
e.____________



f.____________



g.____________



9. List four basic rules concerning the care of forming tools.

   a.

   b.

   c.

   d.

10. List six basic rules concerning the safe use of forming tools.

   a.

   b.

   c.

   d.

   e.

   f.

FORMING TOOLS
UNIT III

ANSWERS TO TEST

1. a. 2
   b. 7
   c. 1
   d. 5
   e. 4
   f. 3
   g. 6
2. a. Claw hammer
   b. Hatchet
   c. Sledge hammer
3. a. 3
   b. 1
   c. 2
4. a. Builder's
   b. Spirit
   c. Torpedo
   d. Line
5. a. 4
   b. 1
   c. 1, 2
   d. 3
6. a. Folding rule
   b. Steel power tape
   c. One hundred foot tape

7. a. 1, 2, 3
   b. 1, 2, 3
   c. 1, 2, 3
8. a. Handsaw
   b. String line (dry line)
   c. Framing square
   d. Chalk line and reel
   e. Wrecking bar
   f. Magnetic nail driver
   g. Utility knife
9. a. Keep tools clean and dry
   b. Keep tools sharp and in good working order
   c. Do not carry builder's level over shoulder
   d. Loosen set screws on builder's level when not in use
10. a. Use the right tool for the right job
    b. Do not use broken tools
    c. Do not throw tools
    d. Be sure tool handles are securely fastened to body of tool
    e. Protect cutting edge of tools when carrying and/or storing
    f. Be sure concrete nails are set tightly into the material before driving them

CEMENT MASON'S

PROGRESS CHART

Section C

Tools and Equipment

Student's Name	UNIT I Hand Tools			UNIT II Power Tools			UNIT III Forming Tools													
Job	1	2	3	1	2	3	1	2	3											
	UNIT TEST			UNIT TEST			UNIT TEST													
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy	85% Correct			85% Correct			85% Correct													
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

BUILDER'S LEVEL
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify the different types of levels and parts of the builder's level. He should demonstrate the ability to set up and adjust the instrument and read the rod. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with the builder's level to the correct definitions.
2. Identify the different types of levels.
3. Name the types of self-reading rods.
4. Identify the parts of the builder's level.
5. Distinguish between the vertical cross hair and the horizontal cross hair on the builder's level.
6. Identify the parts of the rod.
7. Name the common errors that contribute to incorrect measurement.
8. List rules to follow in providing care of the level.
9. Identify hand motions used by the instrument man to guide the target man.
10. Demonstrate the ability to:
    a. Read the self-reading rod.
    b. Set up and adjust the builder's level.

BUILDER'S LEVEL
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in the job sheet.

   G. Invite local surveyor or professional instrument man to come and demonstrate use of builder's level.

   H. Assign student a leveling job.

   I. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheet.

   D. Demonstrate the ability to accomplish the procedures outlined in the job sheet.

   E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

C. Transparency masters

1. TM 1--Types of Levels
2. TM 2--Self-Reading Rods
3. TM 3--Parts of the Builder's Level
4. TM 4--Parts of the Leveling Rod
5. TM 5--Hand Motions
6. TM 6--Reading the Rod

D. Assignment Sheet #1--Read the Self-Reading Rod

E. Answers to assignment sheet

F. Job Sheet #1--Set Up and Adjust Builder's Level

G. Test

H. Answers to test

II. References:

A. Schwab, Glenn O., Richard L. Frevert, Kenneth K. Barnes, and Talcott W. Edminster. *Elementary Soil and Water Engineering.* New York: John Wiley and Sons, Inc.

B. Phillips, Lloyd J., H. F. McColly, L. L. Scranton, and G. C. Cook. *Farm Mechanics Text and Handbook.* Danville, Illinois: The Interstate Printers and Publishers, Inc.

C. *Setting Up the Instrument: A Color Filmstrip and Manual.* San Luis Obispo: California State Polytechnic College.

D. *Reading the Rod: A Color Filmstrip and Manual.* San Luis Obispo: California State Polytechnic College.

BUILDER'S LEVEL
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Bench mark (BM)--Permanent point of known or assumed elevation

(NOTE: Specific point on curb or culvert is sometimes used.)

B. Temporary bench mark (TBM)--Serves as elevation reference point

C. Fall--Pertaining to the slope of a line, such as inches of fall per foot of run

Example: 1" fall per 1' of run

D. Grade line--Proposed or future level of ground at construction line

E. Height of instrument (H.I.)--Elevation of the level line of sight or of the cross hairs in the telescope with respect to the bench mark (height of instrument above or below bench mark)

F. Grade stake--Stake driven into the ground locating the proposed grade

(NOTE: Read from the bench mark.)

G. Site--Plot of ground on which a project is to be constructed

H. Line of sight--Level line through the instrument, as viewed by the eye

(NOTE: The place where the vertical hair crosses the horizontal hair is called the "line of sight.")

I. Self-reading rod--Scale on rod adjusted to height of instrument elevation and direct surface elevation read by instrument man

J. Differential leveling--Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark

K. Level rod--Rod used in leveling, normally graduated in tenths and hundredths of a foot

II. Types of levels (Transparency 1)

A. Engineer's dumpy

B. Engineer's wild tilting

INFORMATION SHEET

C. Turret

D. Engineer's zeiss

E. Builder's

(NOTE: The builder's level is the most practical and economical for general use and is sufficiently accurate for most purposes.)

III. Types of self-reading rods (Transparency 2)

A. Philadelphia or "Philly" rod

B. Elevation or "Linker" rod

IV. Parts of the builder's level (Transparency 3)

A. Eye piece

B. Telescope barrel

C. Focusing screw

D. Sun shade

E. Bubble tube

F. Leveling head

G. Leveling screw

H. Head plate

I. Tripod

J. Leg thumb nut

K. Slow motion screw

L. Clamp

V. Cross hairs

A. Vertical--Indicates direction

B. Horizontal--Indicates flat plane

C. Cross of the two--Designates point on "line of sight;" intersection of cross hairs and the optical center of objective lense

INFORMATION SHEET

VI. Parts of the rod (Transparency 4)

- A. Target face--Red and white disc on rod used for certain types of readings
- B. Target clamp--Holds the target in place
- C. Rod clamp--Holds the rod when extended
- D. Vernier scale--Found on target face and rod clamp; enables reading to the nearest thousandth of a foot

VII. Common errors in measurement

- A. Tape not pulled tight enough
- B. Tape not in proper alignment
- C. Plumb bob not used when measuring on slope

  (NOTE: The plumb bob is used to maintain horizontal measurement.)
- D. Reading or recording the wrong numbers (human errors)

VIII. Care of the level

- A. Protect against shock and vibration during transport
- B. Keep in box except when in use
- C. Place lens and tripod cap in box after removing from instrument
- D. Attach instrument onto tripod carefully and firmly before moving tripod

  (NOTE: Never force screws or other moving parts of an instrument.)
- E. Always use sunshade regardless of the weather
- F. Clean lenses with soft tissue

  (CAUTION: Do not clean with fingers or rough cloth. Do not remove lenses.)
- G. Loosen set screws when not in use

IX. Hand motions (Transparency 5)

X. Reading the rod (Transparency 6)

- A. Graduations
  - 1. Feet
  - 2. Tenths of feet

INFORMATION SHEET

    3. Hundredths of feet
    4. Thousandths of feet

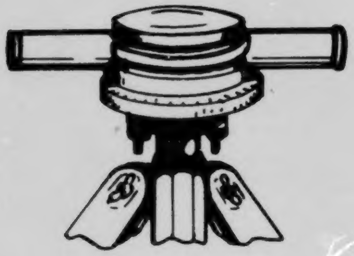
B. Red numbers designate feet

C. Black numbers indicate tenths of feet

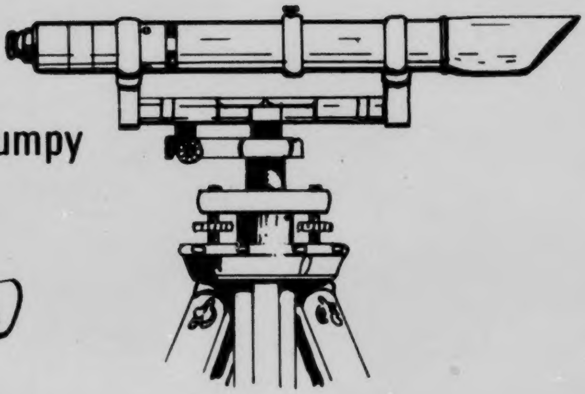
D. Black and white marks show hundredths of feet

E. Vernier scale reads thousandths of feet

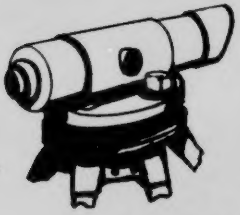
Types of Levels



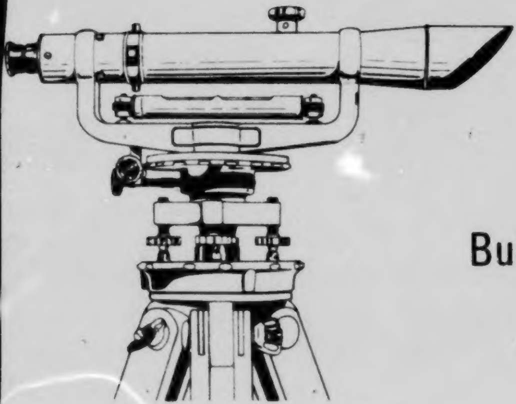
Turret



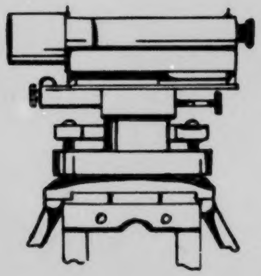
Engineer's Dumpy



Engineer's Zeiss



Builder's

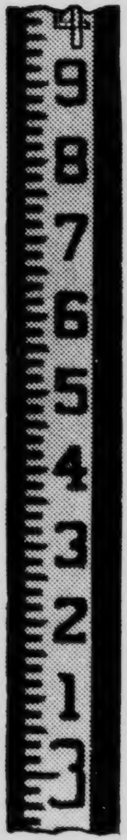


Engineer's Wild Tilting

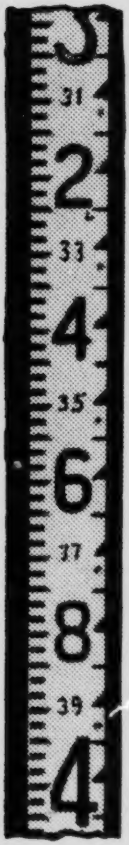
Self-Readin

Positive
↑
Reading

Philadelphia
or
"Philly" Rod


4
9
8
7
6
5
4
3
2
1
3

eading Rods


3
31
2
33
4
35
6
37
8
39
4

Direct

↓

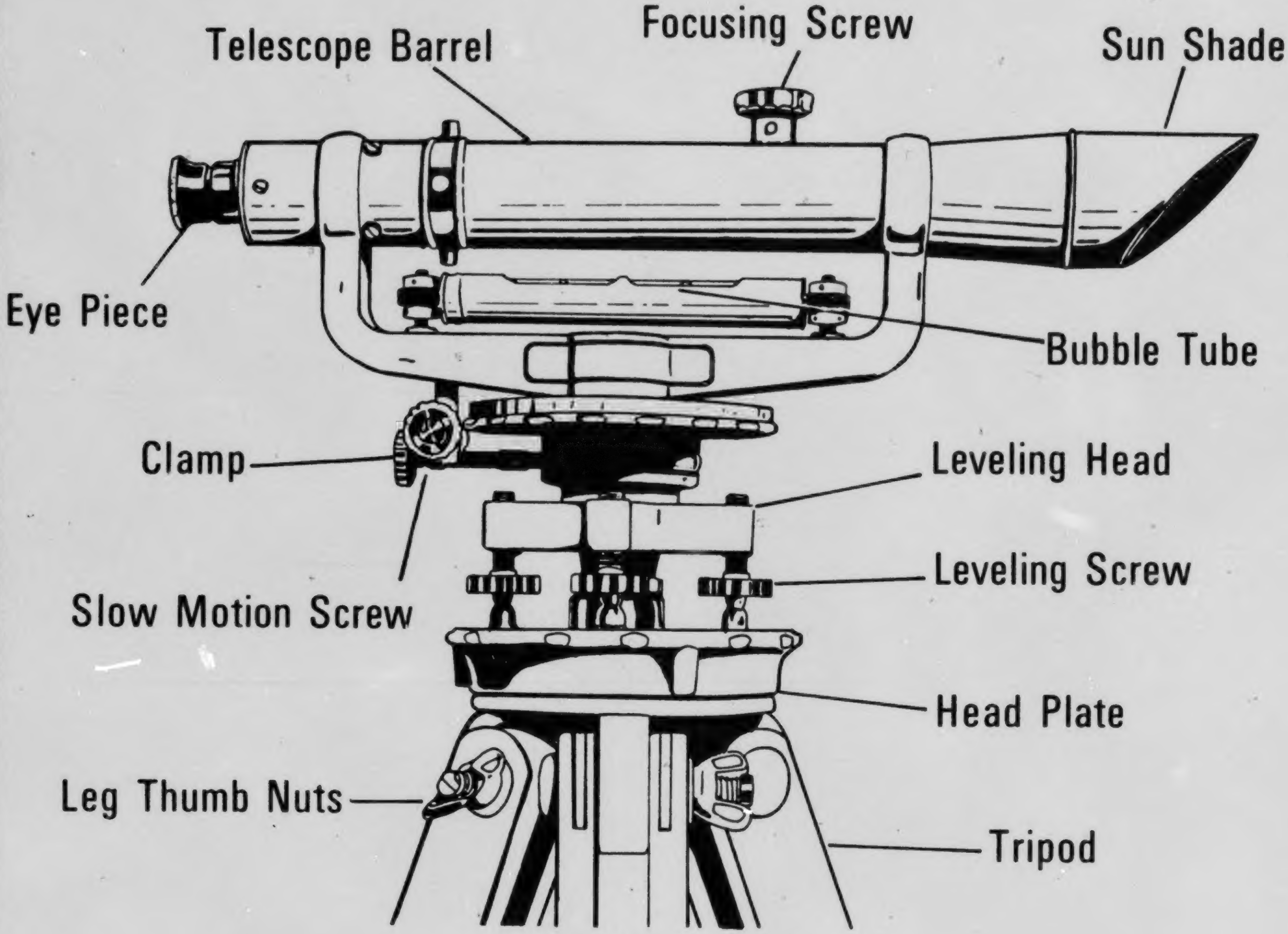
Reading

Elevation

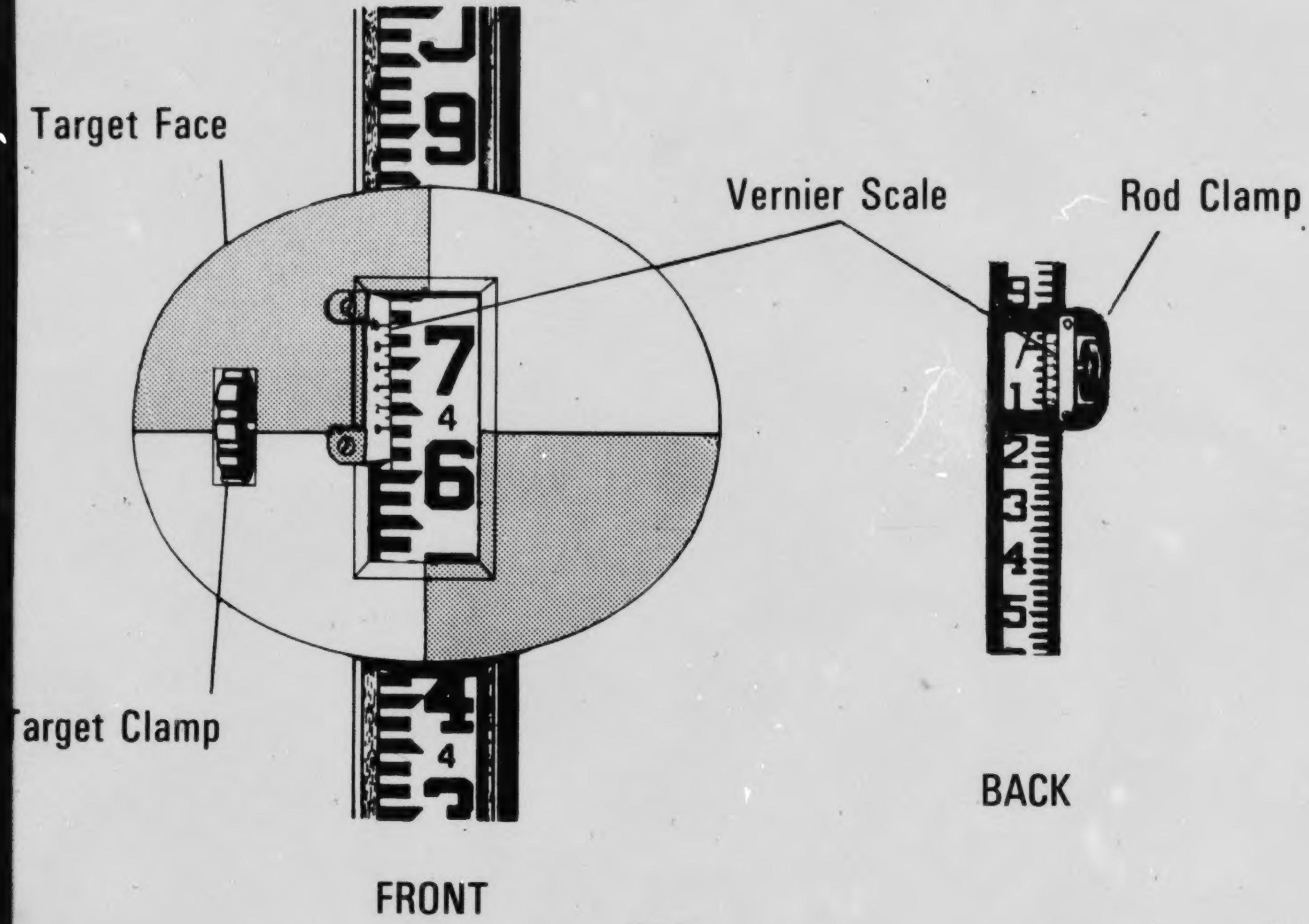
or

"Linker" Rod

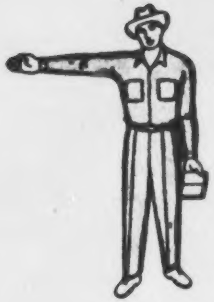
Parts of the Builder's Level


Telescope Barrel
Focusing Screw
Sun Shade
Eye Piece
Bubble Tube
Clamp
Leveling Head
Leveling Screw
Slow Motion Screw
Head Plate
Leg Thumb Nuts
Tripod

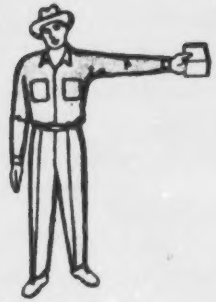
Parts of the Leveling Rod


Target Face
Vernier Scale
Rod Clamp
arget Clamp
9
7
4
6
4
4
9
1
2
3
4
5
FRONT
BACK

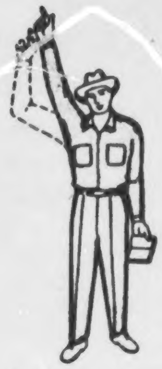
Hand Motions



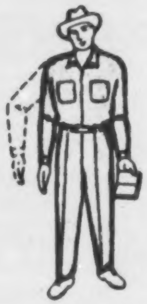
Move in this Direction



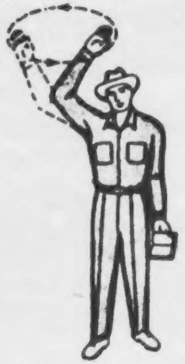
Move in this Direction



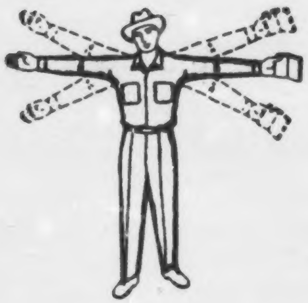
Move Up



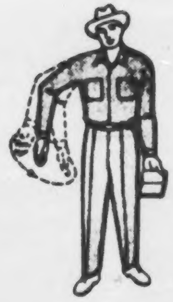
Move Down



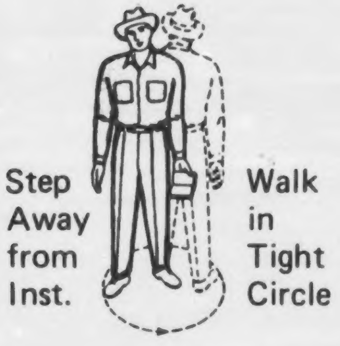
Turning Point



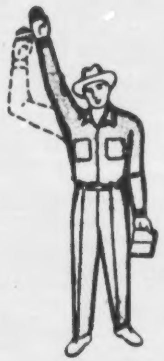
Observation Completed
or Move On
or Understood



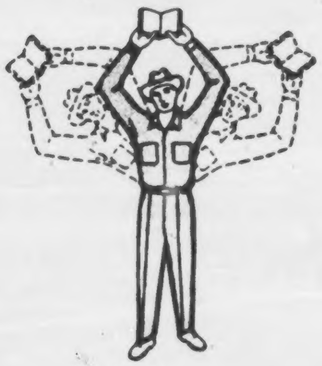
Come In


Step Away from Inst.
Walk in Tight Circle

Wrong Face
or Check Clamp
or Rod Upside Down

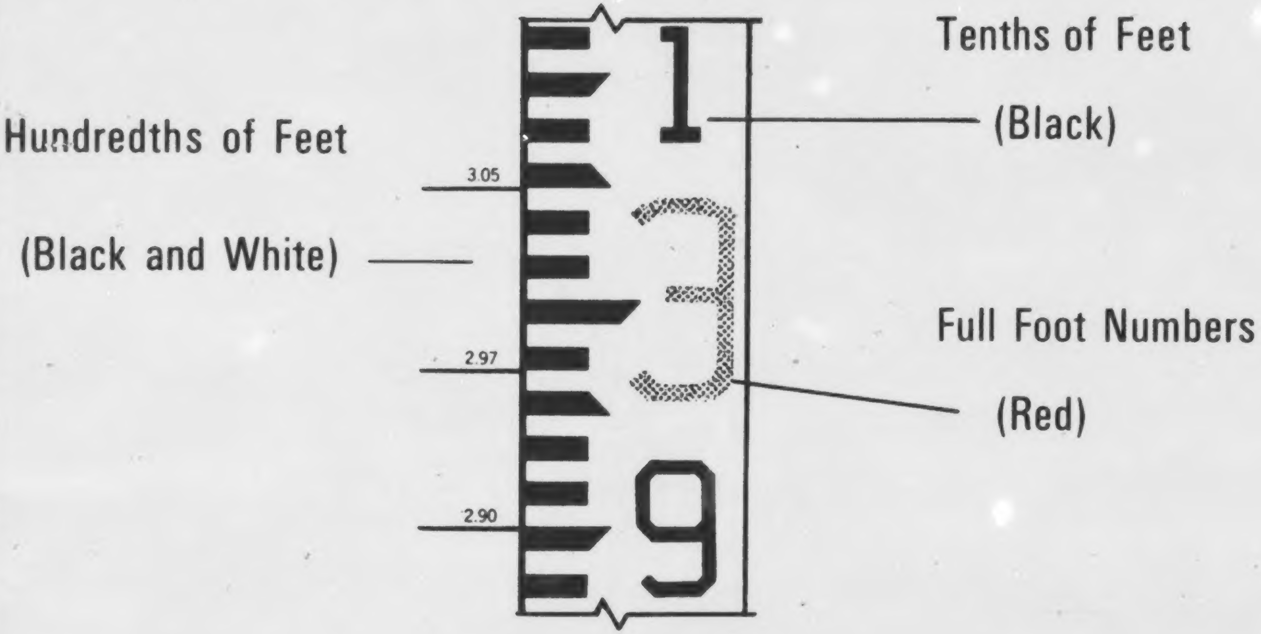


Use
Long Rod



Wave Rod from
Side to Side

Reading the Rod

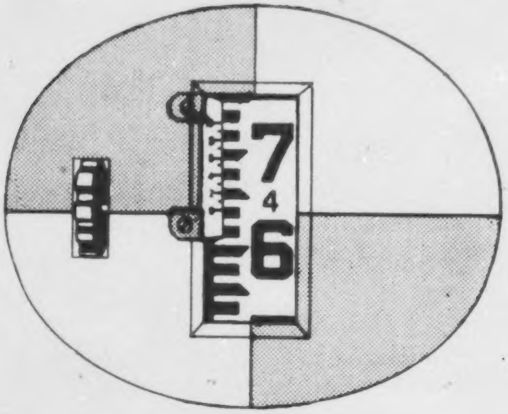

Tenths of Feet
(Black)
Hundredths of Feet
(Black and White)
3.05
2.97
2.90
1
3
9
Full Foot Numbers
(Red)

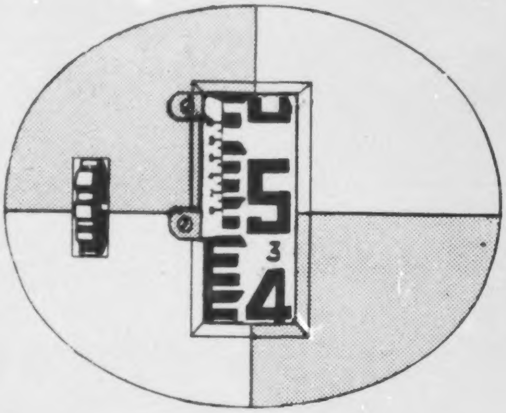
NOTE: Vernier scale reads thousandths of feet

BUILDER'S LEVEL
UNIT I

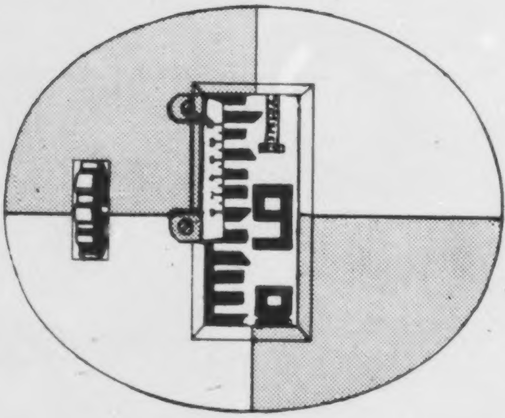
ASSIGNMENT SHEET #1--READ THE SELF-READING ROD

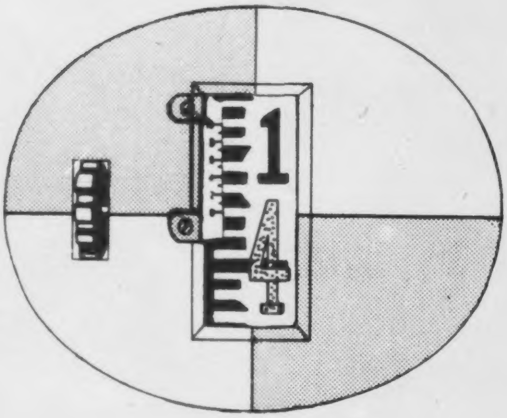
Read each of the illustrations below to the nearest hundredth. Record your results in the blanks provided.





a. ____________________ b. ____________________





c. ____________________ d. ____________________

BUILDER'S LEVEL
UNIT I

ANSWERS TO ASSIGNMENT SHEET

a. 4.64

b. 3.48

c. .90

d. 4.05

BUILDER'S LEVEL
UNIT I

JOB SHEET #1--SET UP AND ADJUST THE BUILDER'S LEVEL

I. Tools and equipment

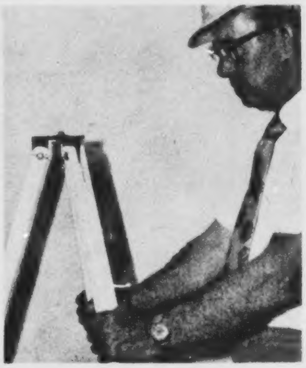
   A. Instrument

   B. Tripod

II. Procedure

   A. Grasp the two legs of the tripod that are nearest you and set the leg shoes in the ground about three feet apart (Figure 1)

FIGURE 1



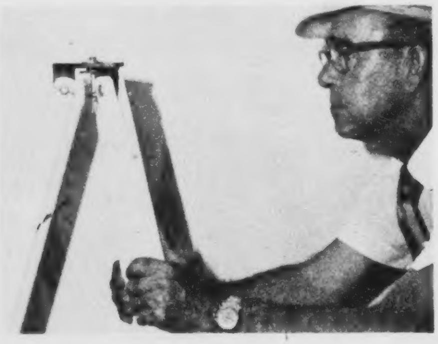
   B. Swing third leg out to form a triangle

   (NOTE: If the ground is not level, you may have to change position of tripod in order to keep headplate level. Always place two legs on downhill or unlevel side.)

   C. Tighten leg thumb nuts

   D. Check headplate to see if it is level (Figure 2)

FIGURE 2

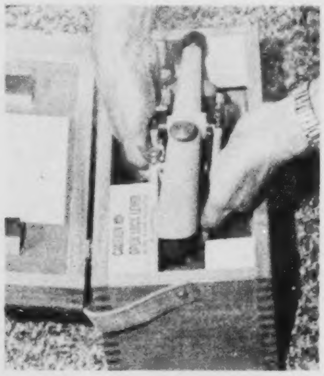


JOB SHEET #1

E. Remove instrument from carrying case by lifting the level bar (Figure 3)

(CAUTION: Never grasp the telescope barrel while removing instrument from carrying case.)

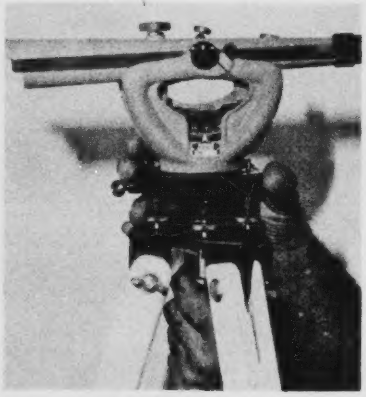
FIGURE 3



F. Attach instrument to head plate by screwing it down (Figure 4)

(CAUTION: Keep a firm grip on instrument until it is securely in position on tripod.)

FIGURE 4



G. Remove dust cap from front lens

(NOTE: The dust cap should be kept in place in order to protect the lens from dust or scratches.)

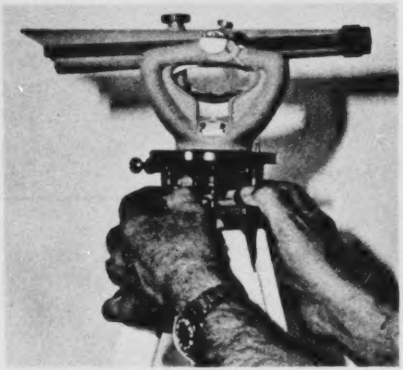
H. Attach sun shade to the instrument

I. Align telescope barrel directly over one pair of leveling screws (Figure 5)

(NOTE: The leveling screws will be used just as the name indicates, to level the instrument.)

JOB SHEET #1

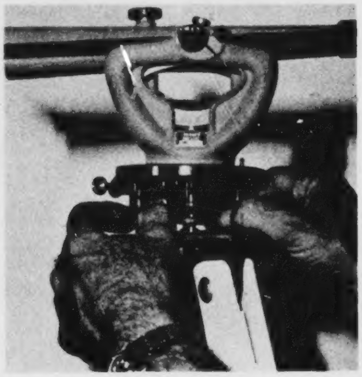
FIGURE 5



J. Rotate screws under the barrel to bring bubble to the center of the leveling tube (Figure 6)

(NOTE: Move your thumbs in opposite directions.)

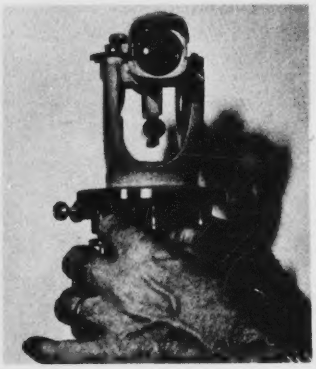
FIGURE 6



K. Check bubble to see if centered

L. Turn instrument clockwise through 90 degrees to align with the other pair of leveling screws (Figure 7)

FIGURE 7



JOB SHEET #1

M. Bring bubble to center of marks by rotating leveling screws

N. Turn instrument clockwise through 90 degrees to bring it parallel with first pair of leveling screws

O. Center bubble again

P. Turn instrument clockwise through 90 degrees to bring it parallel with second pair of leveling screws

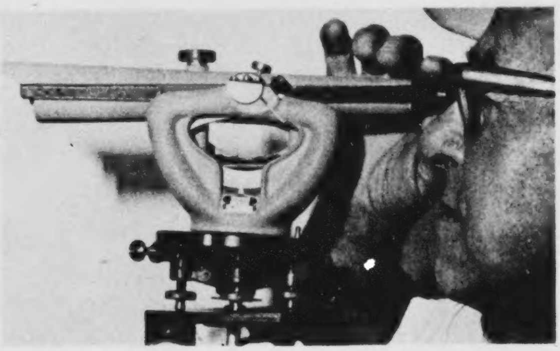
Q. Center bubble again

(NOTE: Bubble should stay in center regardless of what direction the telescope is pointing. If bubble does not, instrument is out of level and should be adjusted by competent personnel.)

R. Focus cross hairs so that they appear sharp and clear (Figure 8)

(NOTE: Focusing is accomplished by looking through the eye piece and by turning the eye piece ring until the cross hairs become sharp or "clear.")

FIGURE 8

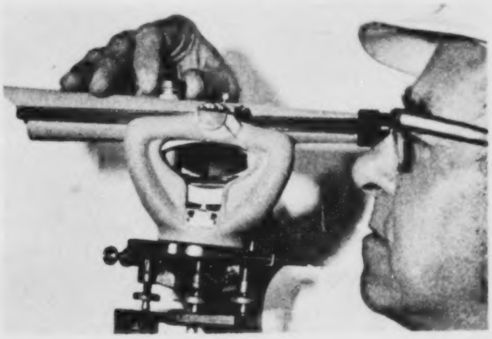


S. Be sure cross hairs are focused

(NOTE: The target may not be in focus.)

T. Rotate the focusing screw to bring target into sharp focus (Figure 9)

FIGURE 9



JOB SHEET #1

(NOTE: When cross hairs and target are in sharp focus, you should be able to read a rod accurately. Always tie level shots back to starting bench mark to check for error in rod shots or in field notes.)

(CAUTION: After instrument is level, keep hands off tripod. Use the instrument only. If instrument creeps off level or is bumped, stop, reset tripod, relevel instrument, and start again from last known good bench mark.)

BUILDER'S LEVEL
UNIT I

TEST

1. Match the terms on the right associated with builder's level to the correct definitions by placing the correct numbers in the blanks provided.

______a. Rod used in leveling, normally graduated in tenths and hundredths of a foot

______b. Plot of ground on which a project is to be constructed

______c. Pertaining to the slope of a line, such as inches of fall per foot of run

______d. Permanent point of known or assumed elevation

______e. Proposed or future level of ground at construction line

______f. Stake driven into the ground locating the proposed grade

______g. Elevation of the level line of sight or of the cross hairs in the telescope with respect to the bench mark (height of instrument above or below bench mark)

______h. Serves as elevation reference point

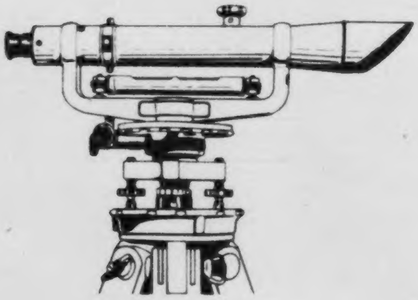
______i. Level line through the instrument, as viewed by the eye

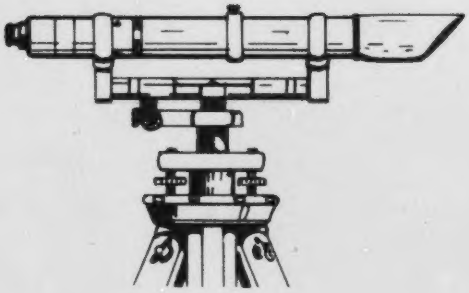
______j. Scale on rod adjusted to height of instrument elevation and direct surface elevation read by instrument man

______k. Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark

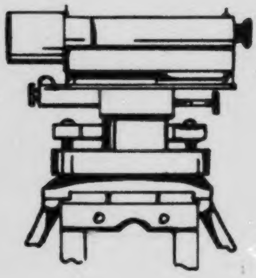
1. Bench mark (BM)
2. Site
3. Line of sight
4. Fall
5. Grade line
6. Grade stake
7. Level rod
8. Height of instrument (H.I.)
9. Self-reading rod
10. Differential leveling
11. Temporary bench mark (TBM)

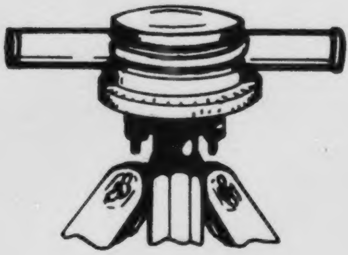
2. Identify the following types of levels.





a.______________________________ b.______________________________





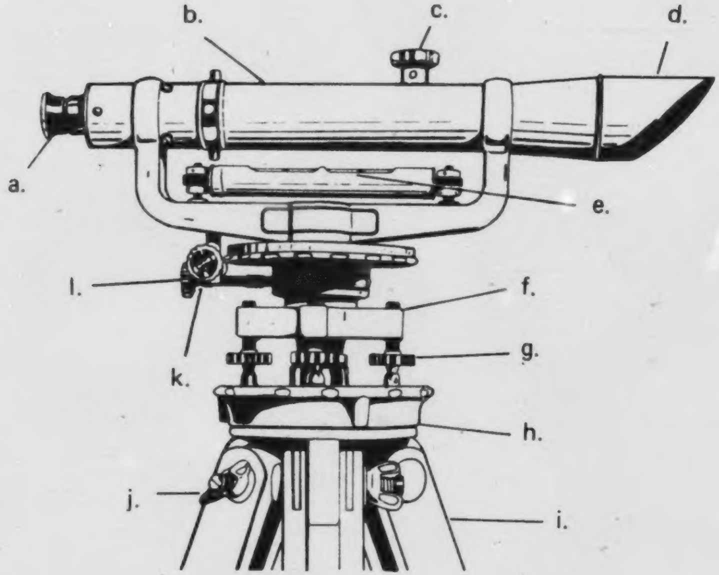
c.______________________________ d.______________________________

3. Name the types of self-reading rods.

a.

b.

4. Identify the parts of the builder's level by writing the correct names in the blanks.



a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

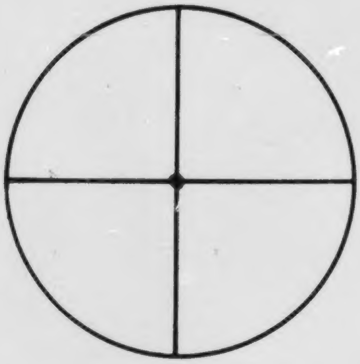
i. ______________________________

j. ______________________________

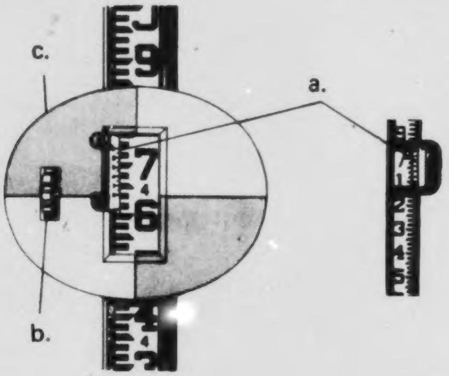
k. ______________________________

l. ______________________________

5. Using the drawing below, place an "X" on the line which indicates the vertical cross hair.



6. Identify the parts of the rod by writing the appropriate names in the blanks provided.



a.______________________________ c.______________________________

b.______________________________

7. Name four common errors that contribute to incorrect measurement.

a.

b.

c.

d.

8. List five rules to follow in providing care of the level.

a.

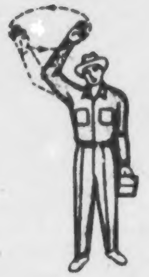
b.

c.

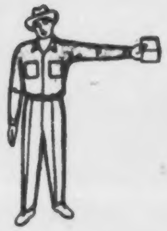
d.

e.

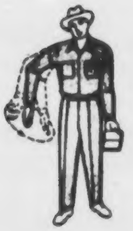
9. Identify the hand motions used by the instrument man to guide the target man.



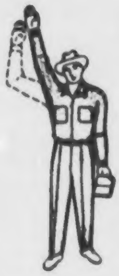
a.____________



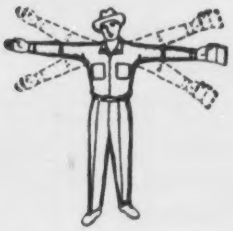
b.____________



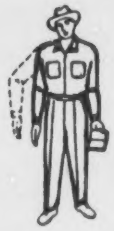
c.____________



d.____________



e.____________



f. ____________

10. Demonstrate the ability to:

a. Read the self-reading rod.

b. Set up and adjust the builder's level.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

BUILDER'S LEVEL
UNIT I

ANSWERS TO TEST

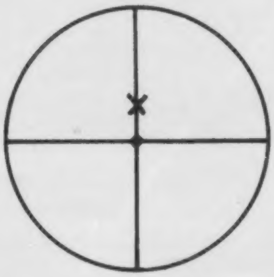
1. a. 7
   b. 2
   c. 4
   d. 1
   e. 5
   f. 6
   g. 8
   h. 11
   i. 3
   j. 9
   k. 10

2. a. Builder's
   b. Engineer's dumpy
   c. Engineer's wild tilting
   d. Turret

3. a. Philadelphia or "Philly" rod
   b. Elevation or "Linker" rod

4. a. Eye piece
   b. Telescope barrel
   c. Focusing screw
   d. Sun shade
   e. Bubble tube
   f. Leveling head
   g. Leveling screw
   h. Head plate
   i. Tripod
   j. Leg thumb nut
   k. Slow motion screw
   l. Clamp

5.



6. a. Vernier scale
   b. Target clamp
   c. Target face

7. a. Tape not pulled tight enough
   b. Tape not in proper alignment
   c. Plumb bob not used when measuring on slope
   d. Reading or recording the wrong numbers (human errors)

8. Any five of the following are acceptable.
   a. Protect against shock and vibration during transport
   b. Keep in box except when in use
   c. Place lens and tripod cap in box after removing from instrument
   d. Attach instrument onto tripod carefully and firmly before moving tripod
   e. Always use sunshade regardless of the weather
   f. Clean lenses with soft tissue
   g. Loosen set screws when not in use

9. a. Turning point
   b. Move rod in this direction (left)
   c. Come in
   d. Use long rod
   e. Observation completed, Move on, or Understood
   f. Move down

10. Performance skills evaluated to the satisfaction of the instructor

SCREEDS AND BULKHEADS
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to distinguish between screeds and bulkheads. He should be able to demonstrate the ability to set bulkheads and types of screeds. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with screeds and bulkheads to the correct definitions.
2. Distinguish between screeds and bulkheads.
3. Identify the spacing of screeds when given a job to be poured.
4. Demonstrate the ability to:
    a. Set bulkheads for 4" slab.
    b. Set wet pads with string line.
    c. Set wet pads with builder's level and rod.
    d. Set pipe screeds with builder's level and rod.
    e. Set grade stakes using a builder's level.
    f. Set grade stakes using a string line.
    g. Set grade stakes using a spirit level and straightedge.
    h. Set adjustable screed chairs using builder's level.

SCREEDS AND BULKHEADS
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheet.

   D. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

   E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Setting Bulkheads

      2. TM 2--Setting Bulkheads (Continued)

   3. TM 3--Screeds and Bulkheads
   4. TM 4--Screeds and Bulkheads (Continued)

D. Assignment Sheet #1--Identify Spacing of Screeds

E. Answers to assignment sheet

F. Job sheets

   1. Job Sheet #1--Set Bulkheads for 4" Slab
   2. Job Sheet #2--Set Wet Pads with String Line
   3. Job Sheet #3--Set Wet Pads with Builder's Level and Rod
   4. Job Sheet #4--Set Pipe Screeds with Builder's Level and Rod
   5. Job Sheet #5--Set Grade Stakes Using a Builder's Level
   6. Job Sheet #6--Set Grade Stakes Using a String Line
   7. Job Sheet #7--Set Grade Stakes Using Spirit Level and Straightedge
   8. Job Sheet #8--Set Adjustable Screed Chairs Using Builder's Level

G. Test

H. Answers to test

II. References:

A. William C. Panarese. *Cement Mason's Guide to Building Concrete Walks, Drives, Patios, and Steps.* Skokie, Illinois: Portland Cement Association, 1971.

B. Diehl, Donald W. and Wayman R. Penner. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1974.

SCREEDS AND BULKHEADS
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Screed--Stake, wet pad, or piece of wood or pipe used as a guide for leveling or grading a concrete slab
- B. Bulkhead--Board set to cut off the concrete pour and to contain the concrete
- C. Wet pad--Fresh concrete that has been set to grade; used to make a screed
- D. Pipe screed--Pipe set on stakes that have been leveled to proper grade; used to rod (drag off) concrete
- E. Drag off--Process of leveling concrete; another term for rodding
- F. Builder's level--Instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels
- G. String line--String used as a guide in setting forms and grades
- H. Adjustable screed chair--Manufactured chair that screws up and down and is used to hold screeds

II. Screeds and bulkheads (Transparencies 1-4)

- A. Screed
  1. Set to grade
  2. Used as a guide for rodding (dragging off) concrete
- B. Bulkhead
  1. Set to grade
  2. Used as a guide for rodding (dragging off) concrete
  3. Used to contain the concrete

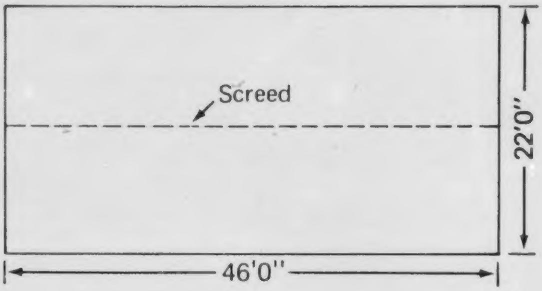
INFORMATION SHEET

III. Spacing screeds

A. When using a twelve foot straightedge, place the screed as shown in Figure 1

(NOTE: For the purpose of this exercise, start pouring on the left end.)

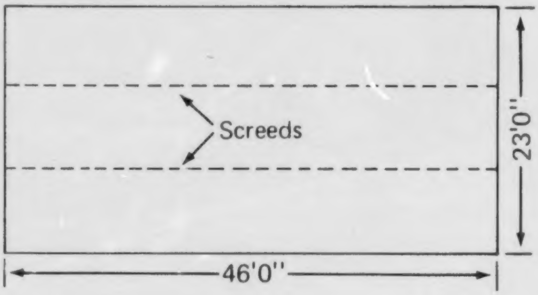
FIGURE 1



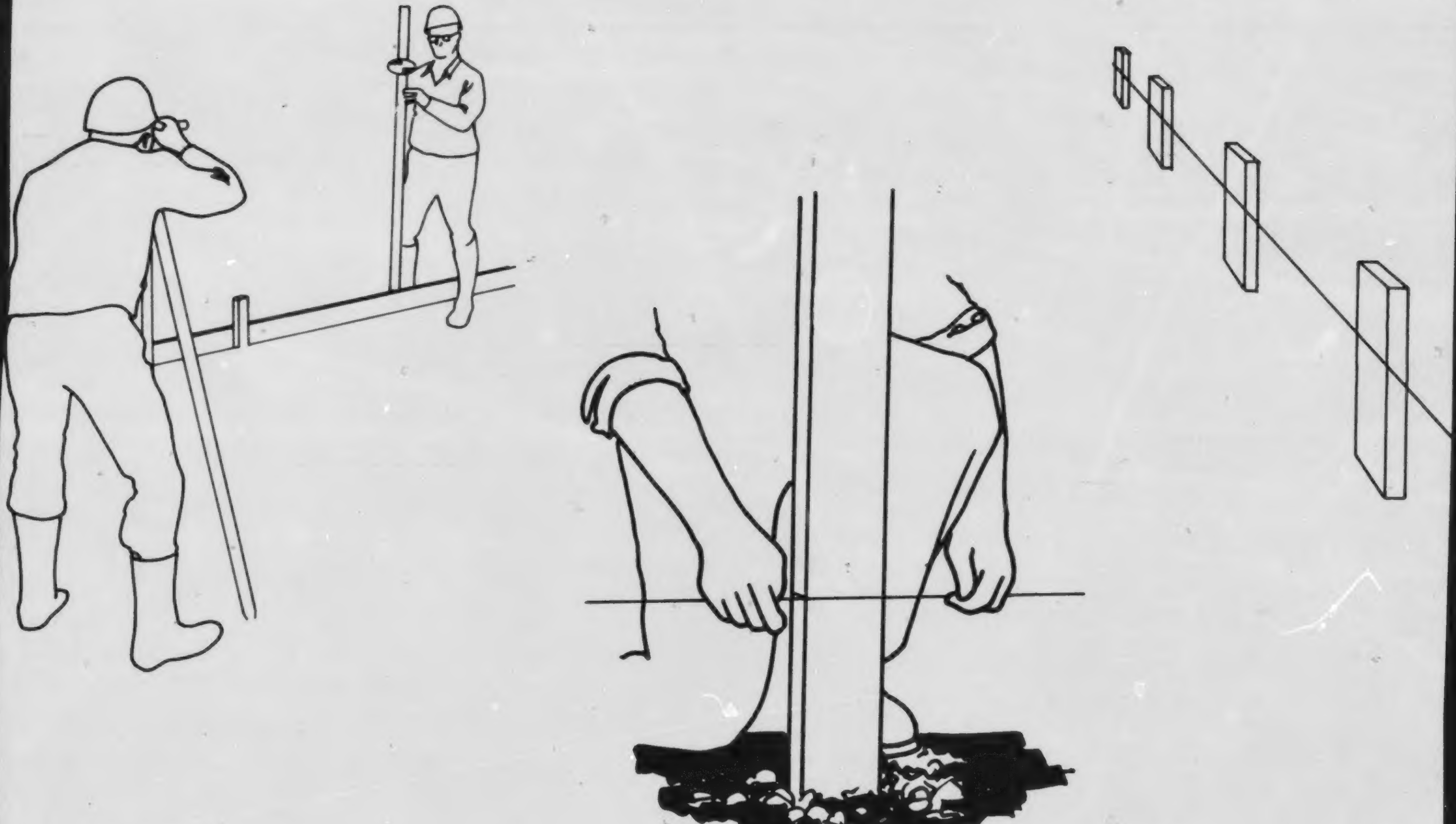
B. When using a nine foot straightedge, place the screed as shown in Figure 2

(NOTE: For the purpose of this exercise, start pouring on the left end.)

FIGURE 2



Setting Bulkheads



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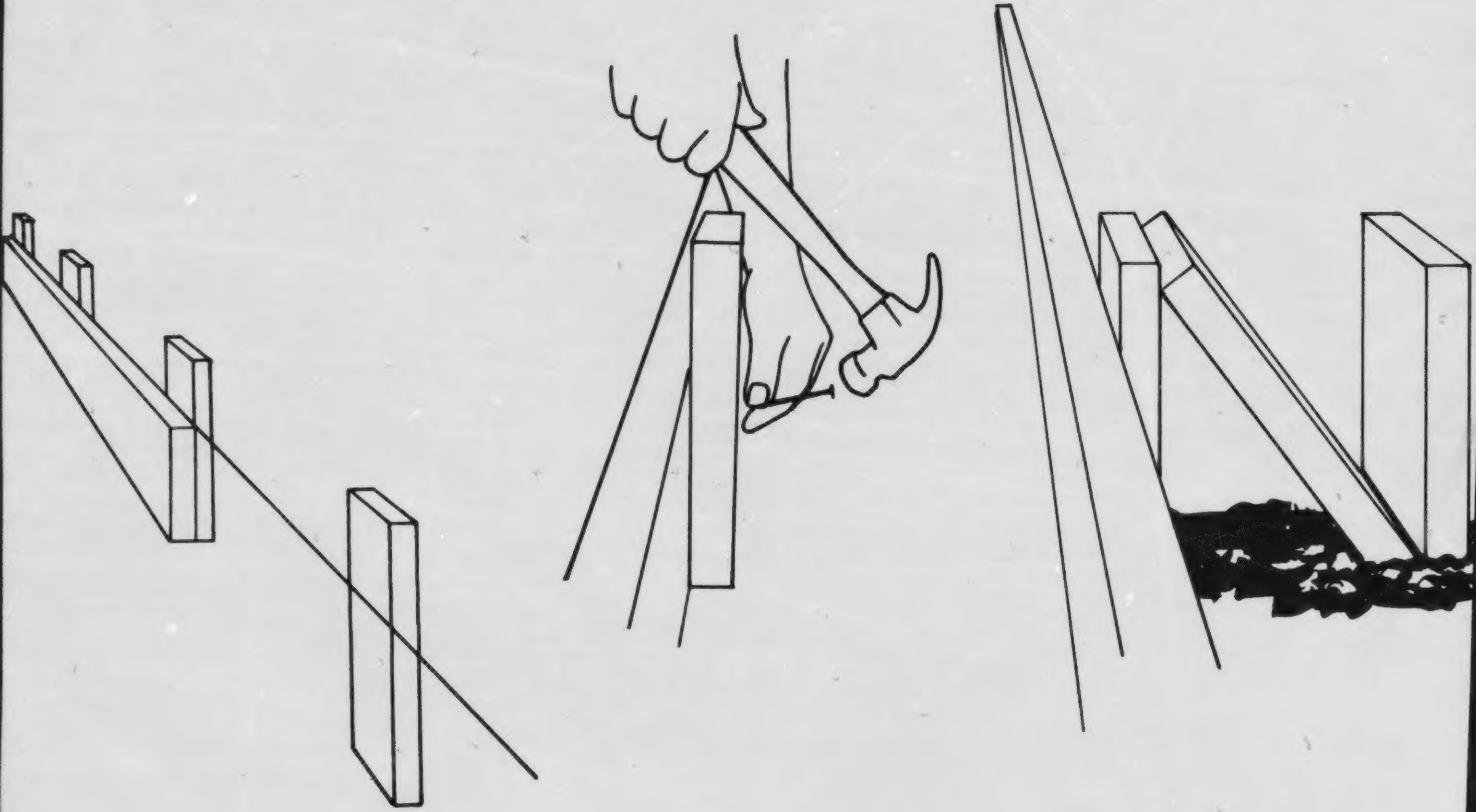
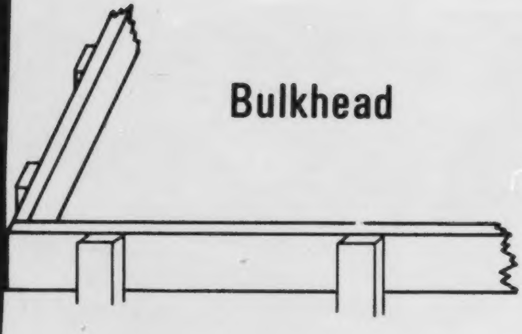
Setting Bulkheads

(Continued)

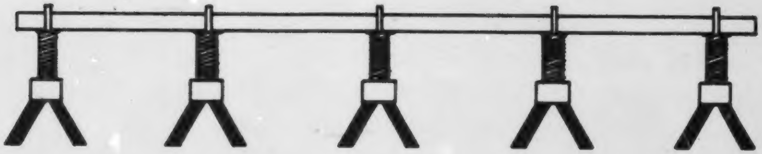


Screeds and Bulkheads

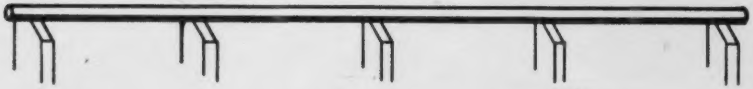


Bulkhead

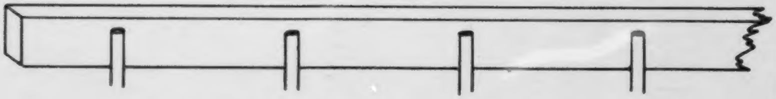
Screeds



Pipe Screed with Adjustable Screed Chairs

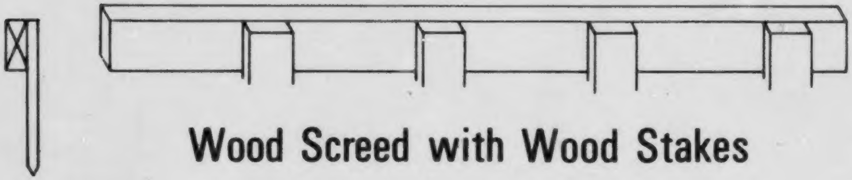


Pipe Screed with Wood Stakes

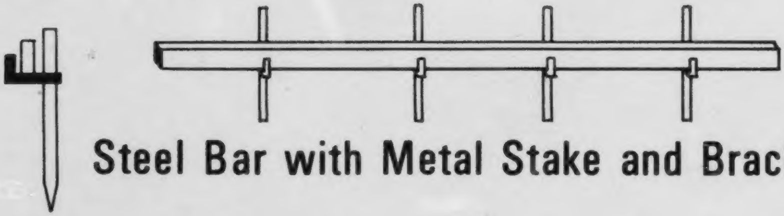


Wood Screed with Metal Stakes

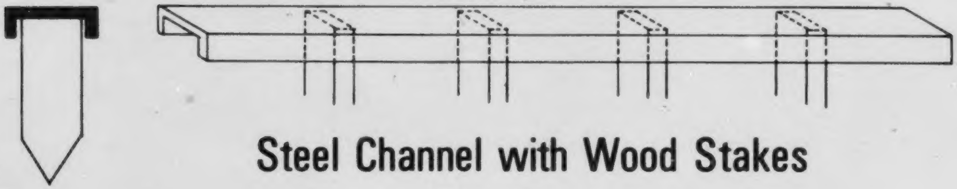
Screeds and Bulkheads
(Continued)



Wood Screed with Wood Stakes



Steel Bar with Metal Stake and Bracket

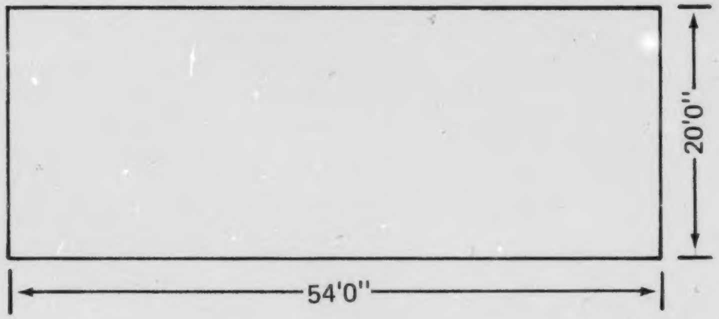


Steel Channel with Wood Stakes

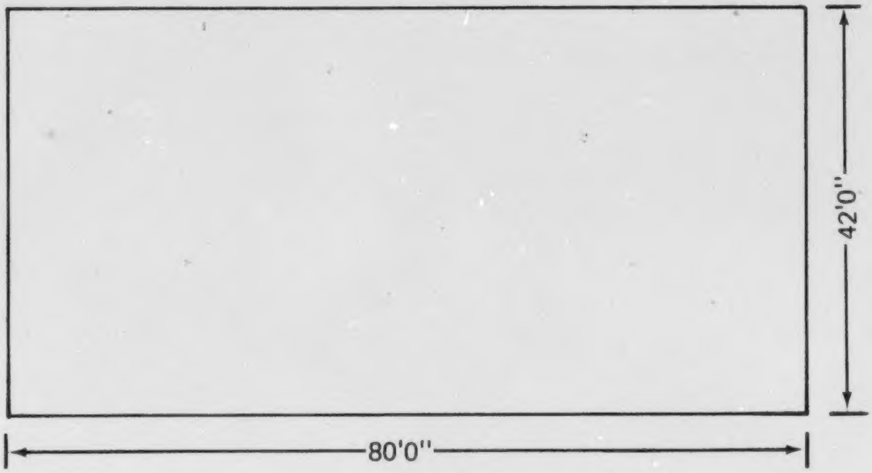
SCREEDS AND BULKHEADS
UNIT II

ASSIGNMENT SHEET #1--IDENTIFY SPACING OF SCREEDS

1. Using a twelve foot straightedge, place a line or lines in the drawing to show where you would set the screed. You would start the pour on the right end and the concrete supply on the left end.



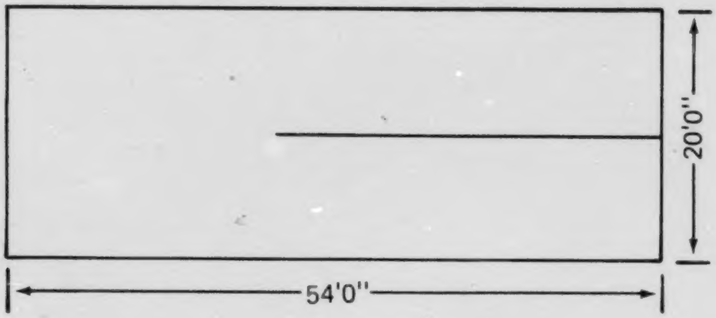
2. Using a twelve foot straightedge, place a line or lines in the drawing to show where you would set a screed or screeds. You would start the pour on the right end and concrete supply on left end.



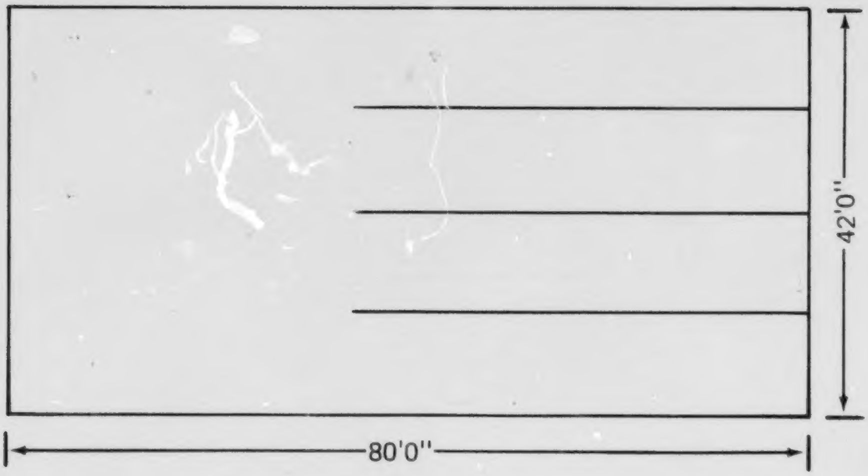
SCREEDS AND BULKHEADS
UNIT II

ANSWERS TO ASSIGNMENT SHEET

1. 10'--Center of drawing



2. 10' 6"--3 screeds spaced evenly apart



SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #1--SET BULKHEADS FOR 4" SLAB

I. Tools and materials

   A. Tools

      1. Sledge hammer

      2. Claw hammer

      3. Hand saw

      4. String line

      5. Builder's level and rod

      6. Folding rule

   B. Materials

      1. 16--2" x 4" x 12' form boards

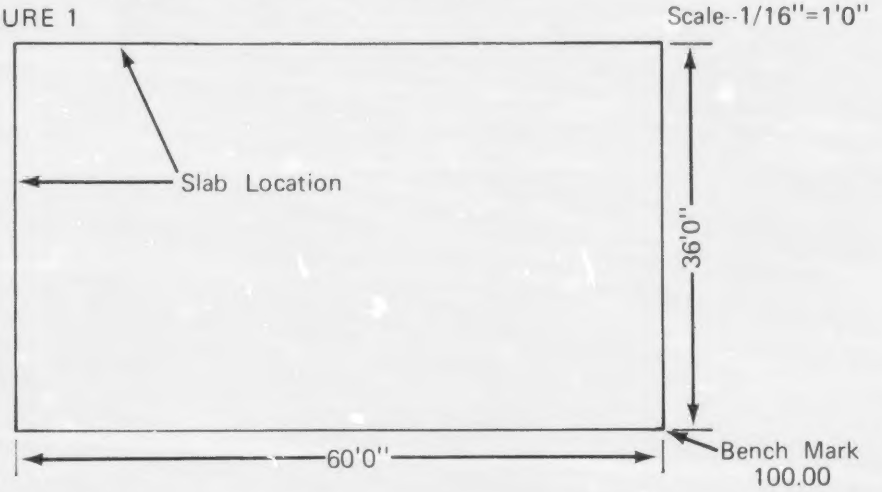
      2. 70 stakes--2" x 4" x 15"

      3. 16d duplex nails

II. Procedure

   A. Establish location of slab (Figure 1)

FIGURE 1

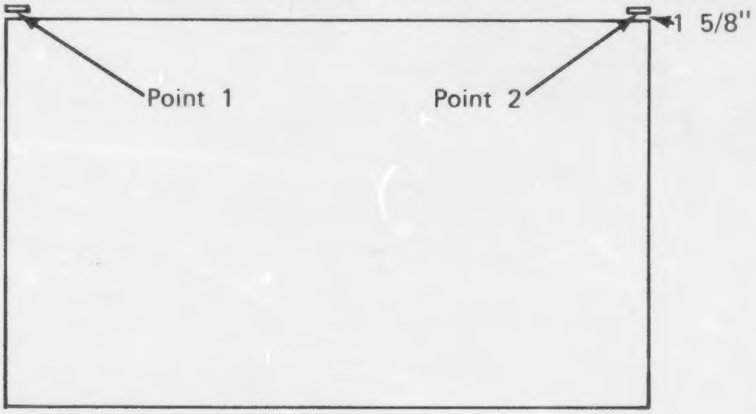

Scale--1/16"=1'0"
Slab Location
36'0"
60'0"
Bench Mark
100.00

JOB SHEET #1

B. Drive a stake at each end at points 1 and 2 tight enough to hold firm (Figure 2)

(NOTE: Allow 1 5/8" for 2 x 4 bulkhead on outside of concrete line.)

FIGURE 2


1 5/8"
Point 1
Point 2

Scale--1/16"=1'0"

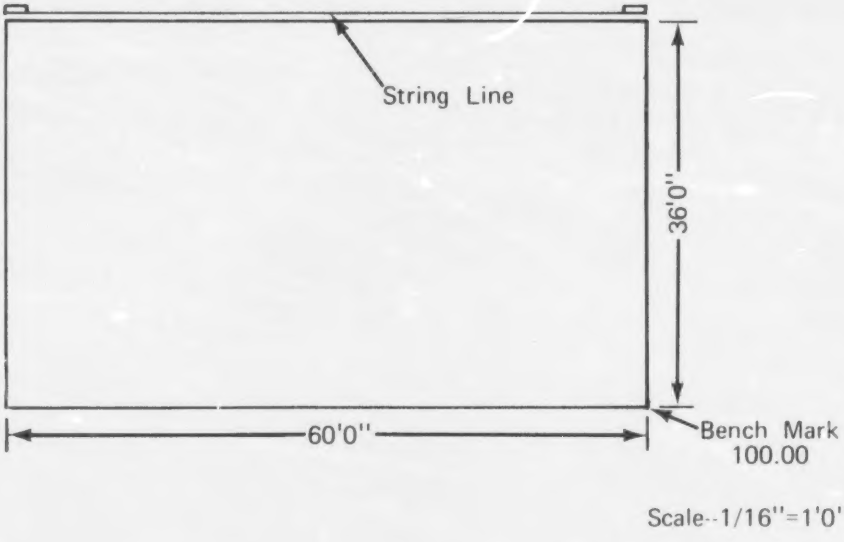
C. Establish grade

D. Use builder's level to shoot grade on each stake

E. Tie string line on grade on inside face of one stake and stretch it to other stake and tie on grade (Figure 3)

(NOTE: Line must be stretched tight enough not to sag.)

FIGURE 3

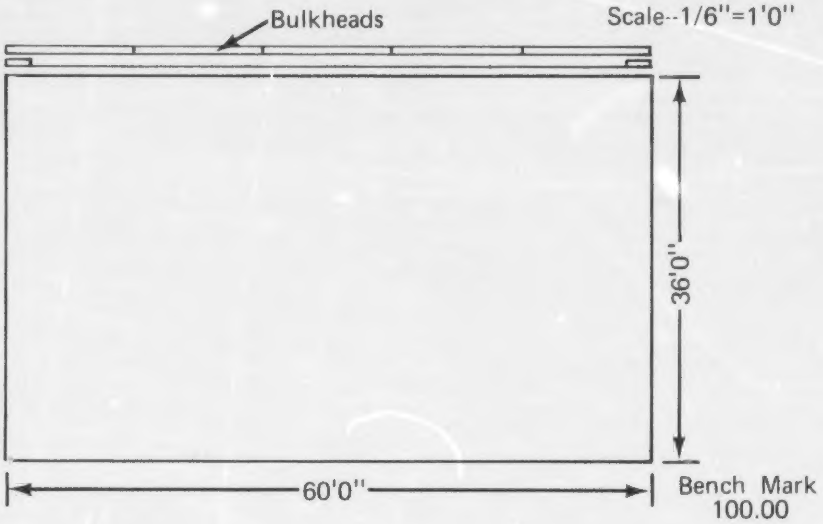

String Line
36'0"
60'0"
Bench Mark
100.00

Scale--1/16"=1'0"

JOB SHEET #1

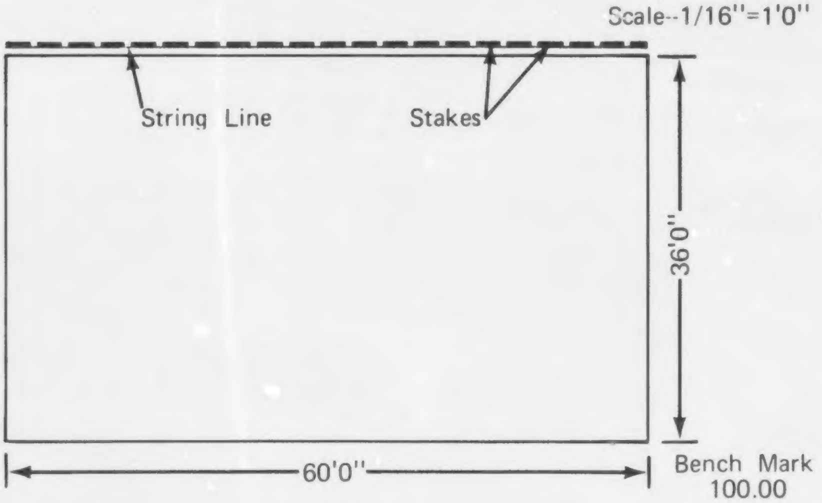
F. Space bulkheads near final position for stake location reference (Figure 4)

FIGURE 4


Bulkheads
Scale--1/6"=1'0"
36'0"
60'0"
Bench Mark
100.00

G. Drive all stakes on outside of this line, using string line as a guide to keep them straight (Figure 5)

FIGURE 5


Scale--1/16"=1'0"
String Line
Stakes
36'0"
60'0"
Bench Mark
100.00

H. Start at one end and nail bulkhead to stakes

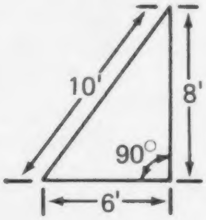
I. Use builder's level and take spot check every few feet to be sure bulkhead is on grade

JOB SHEET #1

J. Use folding rule and square right angle bulkhead off of one already set (Figure 6)

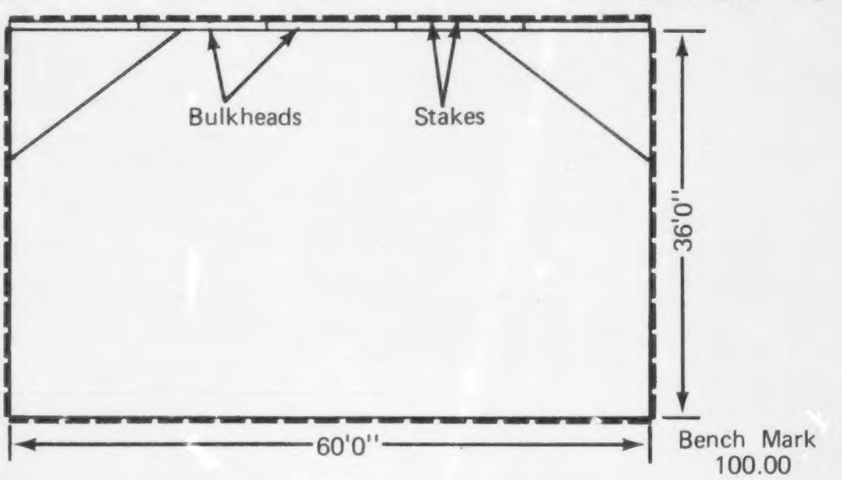
(NOTE: To square form with rule any multiples of 3-4-5 may be used, such as 6-8-10, 9-12-15, or 12-16-20.)

FIGURE 6



K. Use same procedure to erect bulkhead on other three sides (Figure 7)

FIGURE 7


Scale--1/16"=1'0"
Bulkheads
Stakes
36'0"
60'0"
Bench Mark
100.00

L. Use builder's level and take spot check every few feet to be sure bulkheads are on grade

SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #2--SET WET PADS WITH STRING LINE

I. Tools and materials

  A. Tools

    1. Shovel

    2. Margin trowel or float

    3. String line

  B. Material--Concrete

II. Procedure (See Figure 1)

  A. Establish location of screed

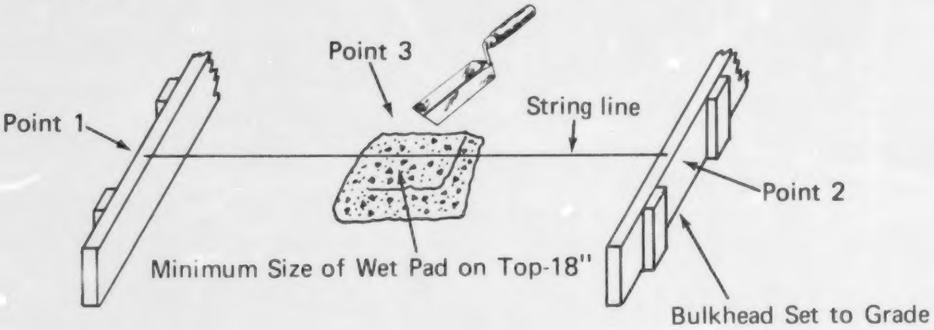
  B. Use shovel to place pile of concrete on established point

  C. Stretch string line from one grade at point 1 to another at point 2 across pile of concrete

  D. Float or trowel pile of concrete to established grade at point 3

  (NOTE: If wet pads are set previous to pour and have already hardened, they must be removed during the pour.)

FIGURE 1


Point 3
Point 1
String line
Point 2
Minimum Size of Wet Pad on Top-18"
Bulkhead Set to Grade

SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #3--SET WET PADS WITH BUILDER'S LEVEL AND ROD

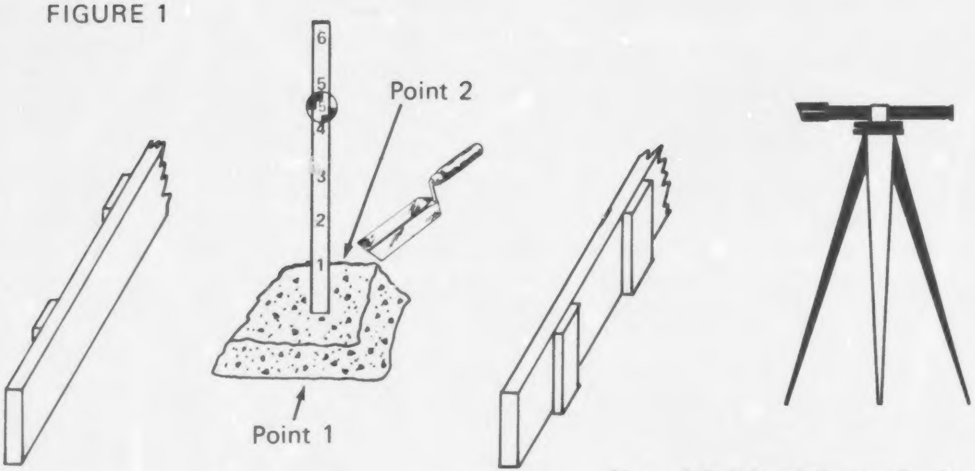
I. Tools and materials

- A. Tools
  - 1. Shovel
  - 2. Margin trowel or float
  - 3. Builder's level and rod
- B. Material--Concrete

II. Procedure (See Figure 1)

- A. Establish location of screed
- B. Use shovel to place pile of concrete at point 1
- C. Set up level and establish grade
- D. Place rod on concrete and shoot finish grade at point 2
- E. Float or trowel pile of concrete to established grade

FIGURE 1


6
5
4
3
2
1
Point 2
Point 1
Top of Bulkhead Set to Grade

SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #4--SET PIPE SCREEDS WITH BUILDER'S LEVEL AND ROD

I. Tools and materials

  A. Tools

    1. Sledge hammer
    2. Claw hammer
    3. Builder's level and rod
    4. String line

  B. Materials

    1. 1 1/2" diameter pipe
    2. 3/4" x 3" x 15" stakes
    3. 8d common nails

II. Procedure

  A. Establish screed location (Figure 1)

  B. Set stake at each end

  C. Stretch string line between two stakes at point 1

  (NOTE: Line is used as a guide to drive stakes in straight line and approximate grade.)

  D. Drive stakes approximately four feet apart

  (NOTE: Distance between stakes will vary according to size of pipe. They should be placed closer together for small diameter pipe.)

  E. Set up level and establish grade

  F. Use level and rod and drive each stake 1 1/2" below finish floor grade (Figure 2)

  G. Place pipe on stakes and drive 8d nails into stakes on each side of pipe screeds to hold it in position

  H. Spot check

  (NOTE: To spot check you will take shots at various points on top of pipe.)

JOB SHEET #4

FIGURE 1

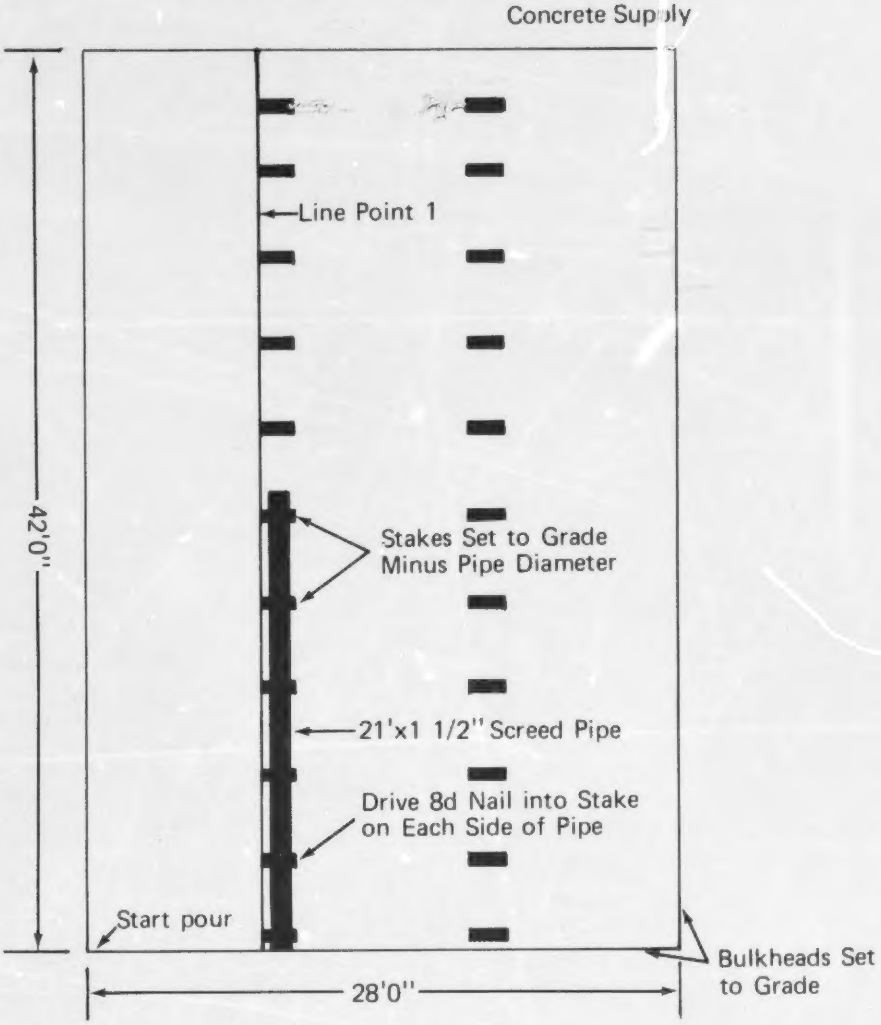
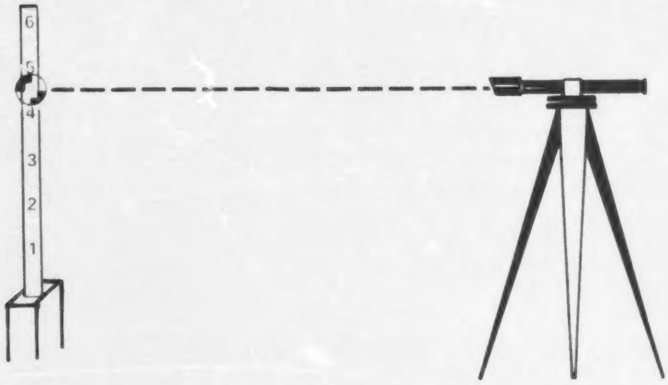

Concrete Supply
Line Point 1
Stakes Set to Grade Minus Pipe Diameter
21'x1 1/2" Screed Pipe
Drive 8d Nail into Stake on Each Side of Pipe
Start pour
Bulkheads Set to Grade
42'0"
28'0"

FIGURE 2



SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #5--SET GRADE STAKES USING A BUILDER'S LEVEL

I. Tools and materials

- A. Tools
  - 1. Sledge hammer
  - 2. Builder's level and rod
- B. Material--Stakes

II. Procedure

- A. Establish stake location (Figure 1)
- B. Drive stakes
- C. Set up level and establish grade
- D. Place leveling rod on stake and shoot grade with level (Figure 2)
- E. Drive stake down until top is on grade

FIGURE 1

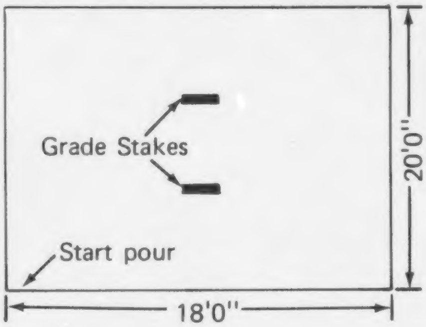
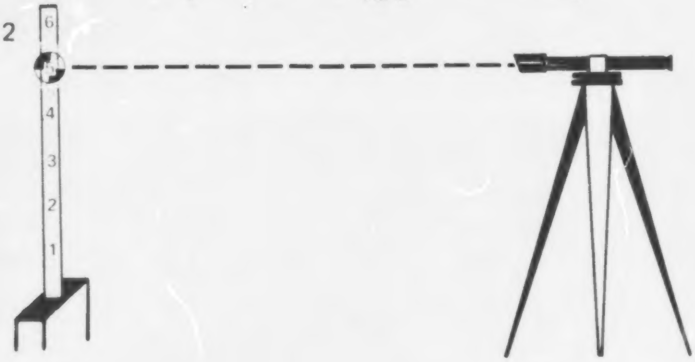

Forms Set to Finish Grade
Grade Stakes
Start pour
20'0"
18'0"

FIGURE 2



SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #6--SET GRADE STAKES USING A STRING LINE

I. Tools and materials

   A. Tools

      1. Sledge hammer

      2. String line

   B. Material--Stakes

II. Procedure

   A. Establish stake location (Figure 1)

   B. Drive stakes

   C. Stretch line from form point 1 to form point 2 along edge of stake to be set at point 3 (Figure 2)

   D. Drive stake down until it reaches proper grade

FIGURE 1

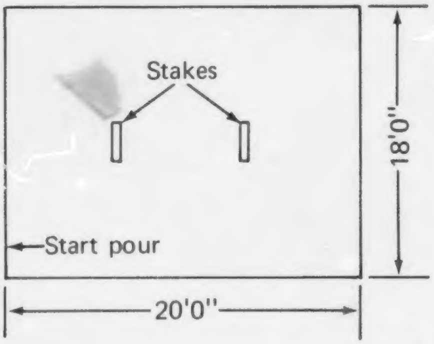
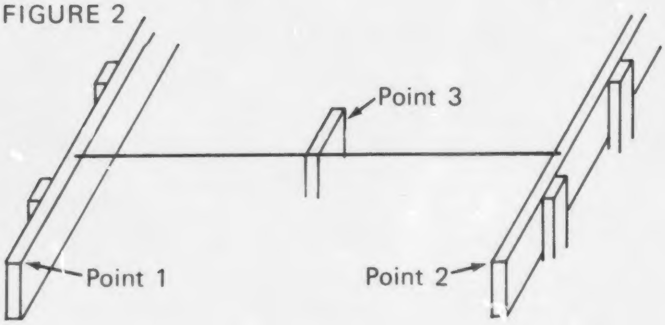

Stakes
18'0"
Start pour
20'0"

FIGURE 2


Point 3
Point 1
Point 2

SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #7--SET GRADE STAKES USING SPIRIT LEVEL AND STRAIGHTEDGE

I. Tools and materials

   A. Tools

      1. Sledge hammer

      2. Spirit level

      3. Straightedge

   B. Material--Stakes

II. Procedure (See Figure 1)

   A. Establish stake location at point 1

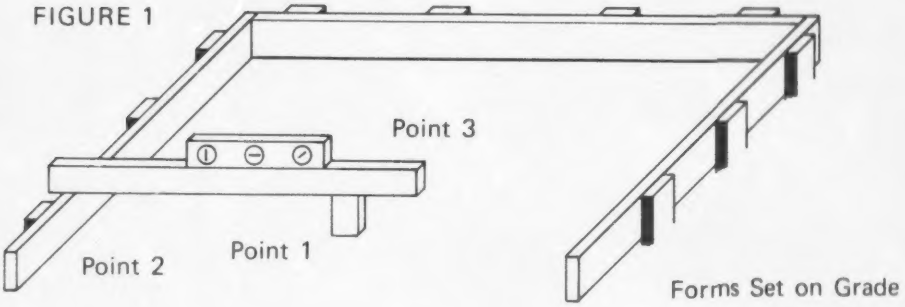
   B. Drive stake

   C. Place one end of straightedge on form that is set to grade at point 2 and other end on stake at point 1

   D. Place level on top of straightedge at point 3

   E. Drive stake down until it is level with form

FIGURE 1



SCREEDS AND BULKHEADS
UNIT II

JOB SHEET #8--SET ADJUSTABLE SCREED CHAIRS USING BUILDER'S LEVEL

I. Tools and materials

- A. Rule or tape
- B. Builder's level and rod
- C. Adjustable chairs

II. Procedure

- A. Establish chair location (Figure 1)
- B. Lay out chairs
- C. Set up level and establish grade
- D. Place leveling rod on each chair and shoot grade with level (Figure 2)
- E. Screw top of chair down to desired grade

FIGURE 1

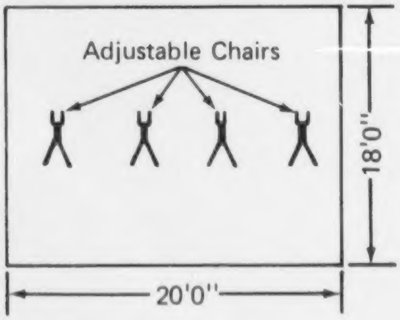
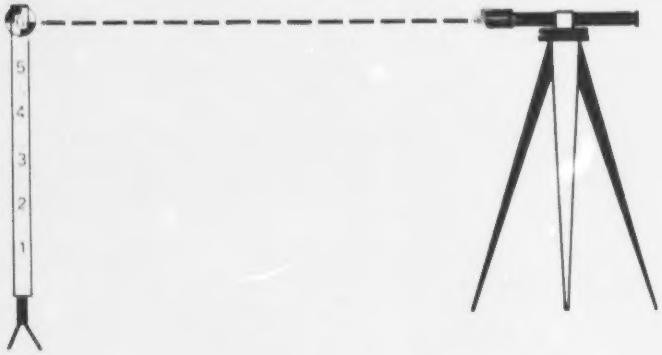


FIGURE 2



SCREEDS AND BULKHEADS
UNIT II

TEST

1. Match the terms on the right to the correct definitions.

_____a. Board set to cut off the concrete pour and to contain the concrete

_____b. Pipe set on stakes that have been leveled to proper grade; used to rod (drag off) concrete

_____c. Stake, wet pad, or piece of wood or pipe used as a guide for leveling or grading a concrete slab

_____d. Fresh concrete that has been set to grade; used to make a screed

_____e. Process of leveling concrete; another term for rodding

_____f. Instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels

_____g. String used as a guide in setting forms and grades

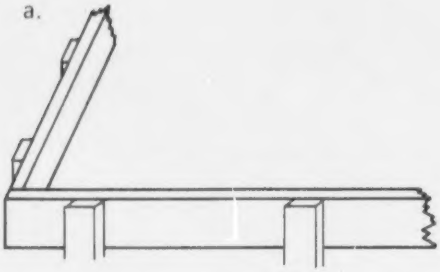
_____h. Manufactured chair that screws up and down and is used to hold screeds

1. Wet pad
2. Bulkhead
3. Pipe screed
4. Screed
5. Builder's level
6. String line
7. Drag off
8. Adjustable screed chair

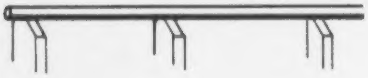
2. Distinguish between a screed and bulkhead by placing an "X" in the blank representing the screed.

a.__________ b.__________

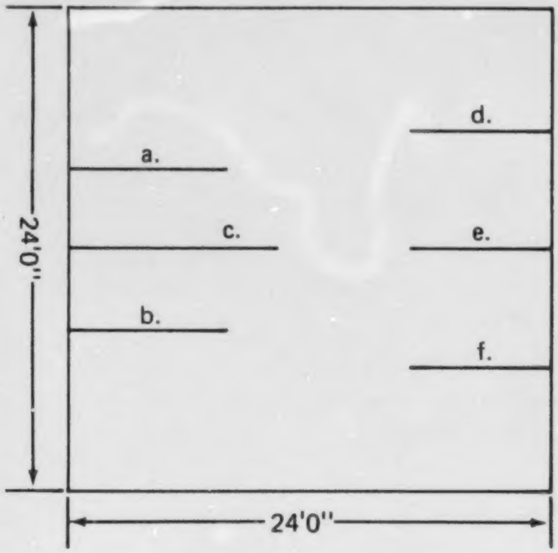
a.



b.



3. Identify the spacing of screeds on the job below using a nine foot straightedge. Circle letter or letters that indicate correct spacing of screeds.



4. Demonstrate the ability to:

   a. Set bulkheads for 4" slab.

   b. Set wet pads with string line.

   c. Set wet pads with builder's level and rod.

   d. Set pipe screeds with builder's level and rod.

   e. Set grade stakes using a builder's level.

   f. Set grade stakes using a string line.

   g. Set grade stakes using a spirit level and straightedge.

   h. Set adjustable screed chairs using builder's level.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SCREEDS AND BULKHEADS
UNIT II

TEST

1. Match the terms on the right to the correct definitions.

_____a. Board set to cut off the concrete pour and to contain the concrete

_____b. Pipe set on stakes that have been leveled to proper grade; used to rod (drag off) concrete

_____c. Stake, wet pad, or piece of wood or pipe used as a guide for leveling or grading a concrete slab

_____d. Fresh concrete that has been set to grade; used to make a screed

_____e. Process of leveling concrete; another term for rodding

_____f. Instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels

_____g. String used as a guide in setting forms and grades

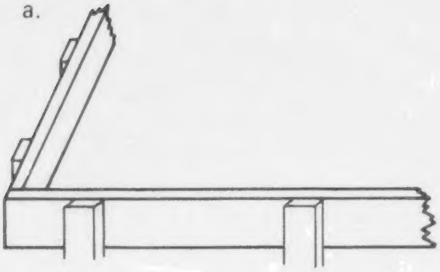
_____h. Manufactured chair that screws up and down and is used to hold screeds

1. Wet pad
2. Bulkhead
3. Pipe screed
4. Screed
5. Builder's level
6. String line
7. Drag off
8. Adjustable screed chair

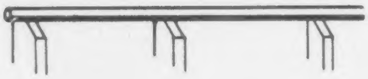
2. Distinguish between a screed and bulkhead by placing an "X" in the blank representing the screed.

a.____________ b.____________

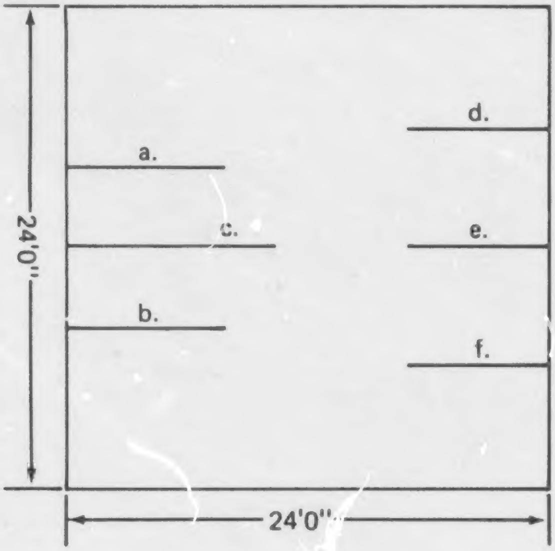
a.



b.



3. Identify the spacing of screeds on the job below using a nine foot straightedge. Circle letter or letters that indicate correct spacing of screeds.



4. Demonstrate the ability to:

   a. Set bulkheads for 4" slab.

   b. Set wet pads with string line.

   c. Set wet pads with builder's level and rod.

   d. Set pipe screeds with builder's level and rod.

   e. Set grade stakes using a builder's level.

   f. Set grade stakes using a string line.

   g. Set grade stakes using a spirit level and straightedge.

   h. Set adjustable screed chairs using builder's level.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SCREEDS AND BULKHEADS
UNIT II

ANSWERS TO TEST

1. a. 2
   b. 3
   c. 4
   d. 1
   e. 7
   f. 5
   g. 6
   h. 8

2. b

3. a and b

4. Evaluated to the satisfaction of the instructor.

PLACING AND RODDING CONCRETE
UNIT III

TERMINAL OBJECTIVE

After the completion of this unit, the student should be able to distinguish between placing and rodding and should be able to identify the different methods of leveling. He should be able to inspect jobs and determine if a job is ready to pour. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with placing and rodding to the correct definitions.
2. Distinguish between placing and rodding.
3. Identify the location to start the pour.
4. State the reasons the subgrade should be moist previous to pour.
5. Identify the different methods of leveling.
6. Name the method of leveling for given jobs to be poured.
7. Inspect a job and complete the checklist.

PLACING AND RODDING CONCRETE
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information and assignment sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Provide job for students to inspect using checklist to determine if job is ready to pour.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheets.

   D. Inspect job using checklist to determine if job is ready to pour.

   E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Placing Concrete

      2. TM 2--Subgrade

   3. TM 3--Methods of Leveling
   4. TM 4--Methods of Leveling (Continued)

D. Assignment sheets

   1. Assignment Sheet #1--Identify Location of Placing
   2. Assignment Sheet #2--Identify Different Methods of Leveling
   3. Assignment Sheet #3--Inspect Job and Complete Checklist

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. *Tips on Control Tests for Quality Concrete.* Skokie, Illinois: Portland Cement Association, 1965.

B. Panarese, William C. *Outdoor Landscaping with Concrete.* Skokie, Illinois: Portland Cement Association, 1971.

C. Taylor, W. H. *Concrete Technology and Practice.* Sydney, Australia: Halstead Press, 1967.

PLACING AND RODDING CONCRETE
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Builder's level--Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels

B. String line--String used as a guide in setting forms

C. Burning forms--Steel that is touching forms

D. Spirit level--Tool used to determine the horizontal plane (level)

E. Boning rod--Set of any three rods of exact length used to sight across to establish a grade

F. Cold joints--Joints where one section has hardened before adjoining section has been poured

G. Subgrade--Soil prepared and compacted to support a structure or a pavement system

II. Placing versus rodding

A. Placing--Process of delivering concrete from the supply and pouring it at the established area inside the forms

B. Rodding--Process of dragging off concrete to a specific grade

III. When placing concrete, start pouring at far point and work back towards supply (Transparency 1)

IV. Reasons subgrade should be moist previous to pour (Transparency 2)

A. To prevent absorption

B. To prevent early set

C. To keep down the temperature of the concrete

V. Methods of leveling (Transparencies 3 and 4)

A. Builder's level

B. String line

(CAUTION: In order to prevent sag, do not stretch line too far between points.)

INFORMATION SHEET

C. Spirit level

D. Boning rod

VI. Methods of leveling for given jobs

A. Builder's level--Large job not practical for any other method and where only bench mark is given as grade

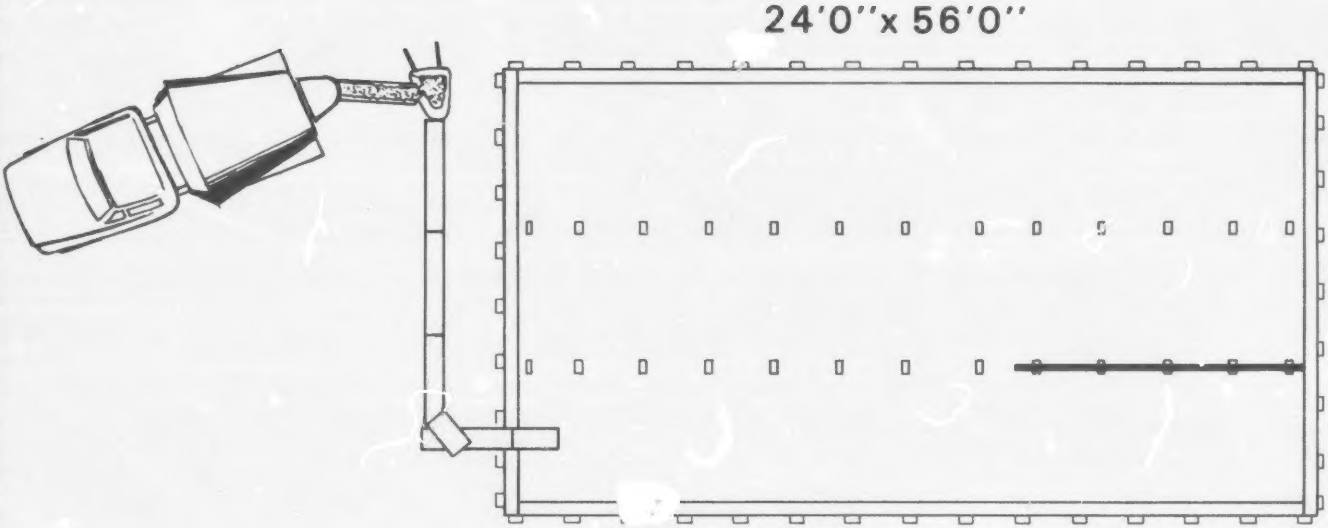
B. String line--Job where grade is given on two sides and where it is necessary to set grade between the sides

C. Spirit level--Job wherever a level or straightedge will reach from point of grade to point where grade is needed

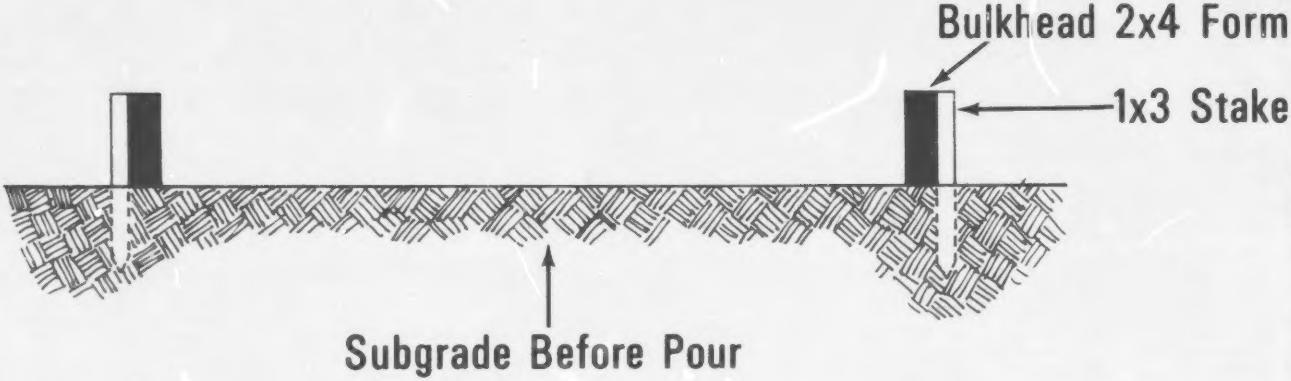
D. Boning rod--Job where no other method is available

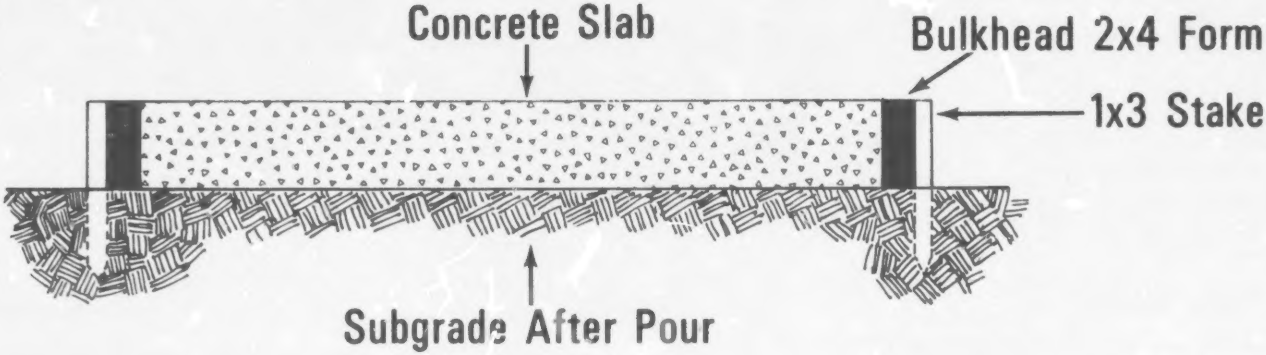
Placing Concrete

Notice that we pour from farthest corner and work back towards our supply. When possible, work short way across slab to prevent having cold joints.

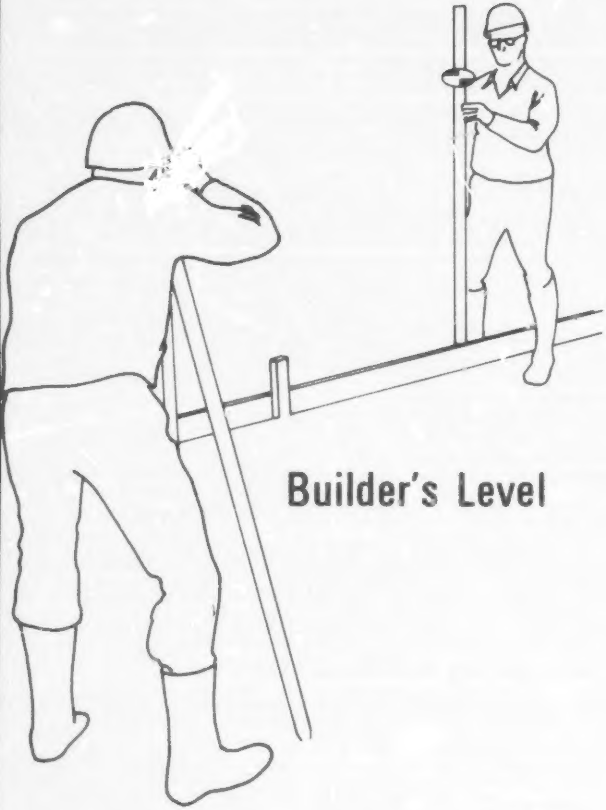


Subgrade

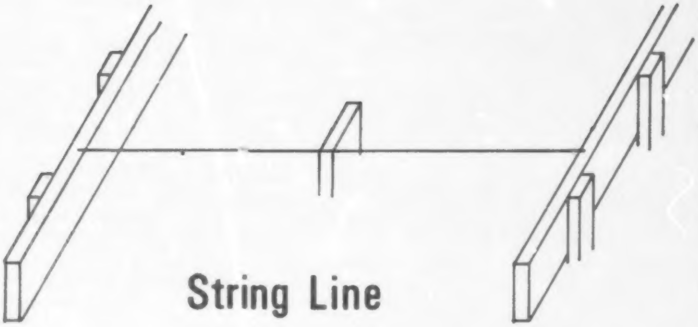

Bulkhead 2x4 Form
1x3 Stake
Subgrade Before Pour


Concrete Slab
Bulkhead 2x4 Form
1x3 Stake
Subgrade After Pour

Methods of Leveling

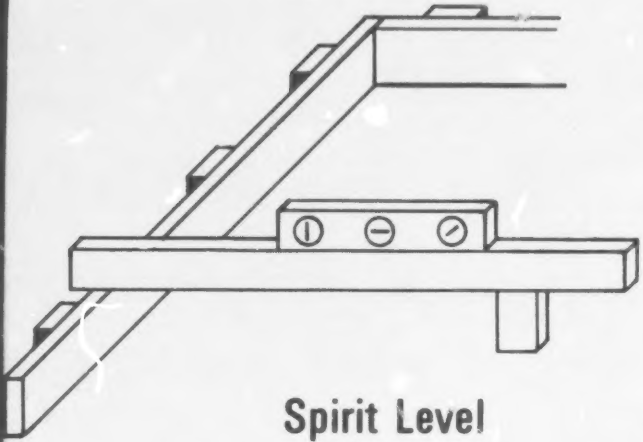


Builder's Level

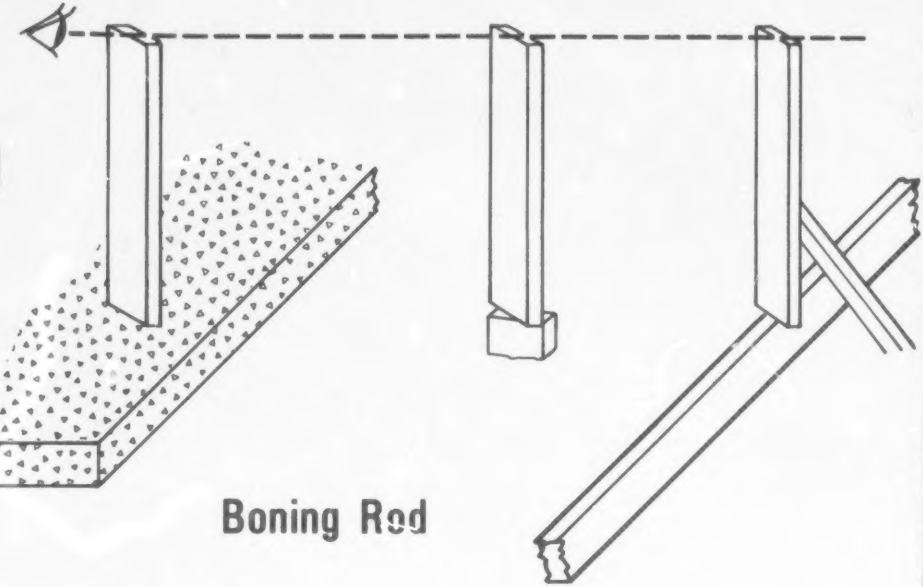


String Line

Methods of Leveling
(Continued)



Spirit Level



Boning Rod

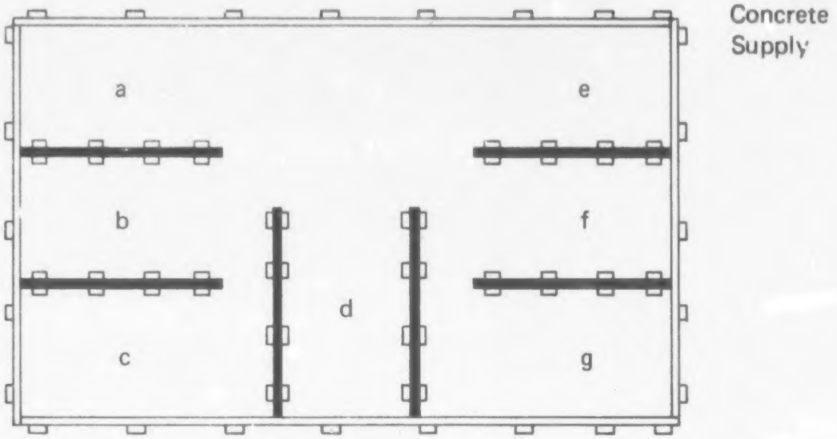
PLACING AND RODDING CONCRETE
UNIT III

ASSIGNMENT SHEET #1--IDENTIFY LOCATION OF PLACING

From the drawings below identify where to start placing. Circle the letter indicating correct location.

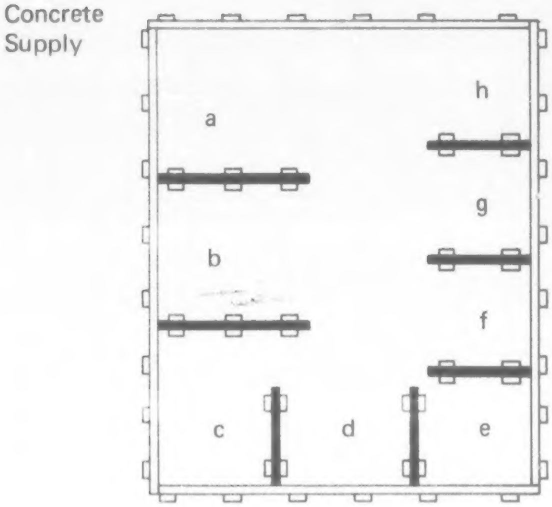
1.

25'0"x40'0"


Concrete
Supply
a
b
c
d
e
f
g

2.

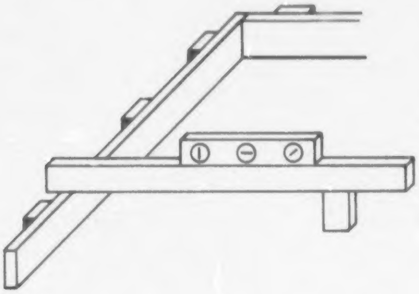
24'0"x32'0"


Concrete
Supply
a
b
c
d
e
f
g
h

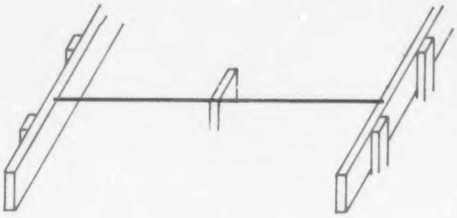
PLACING AND RODDING CONCRETE
UNIT III

ASSIGNMENT SHEET #2--IDENTIFY DIFFERENT METHODS OF LEVELING

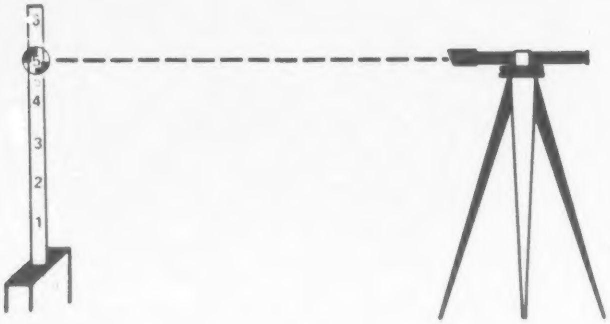
Place the names of the methods of leveling in the blanks.



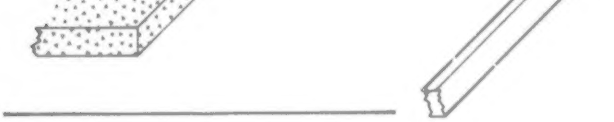
1. ______________________________



2. ______________________________



3. ______________________________



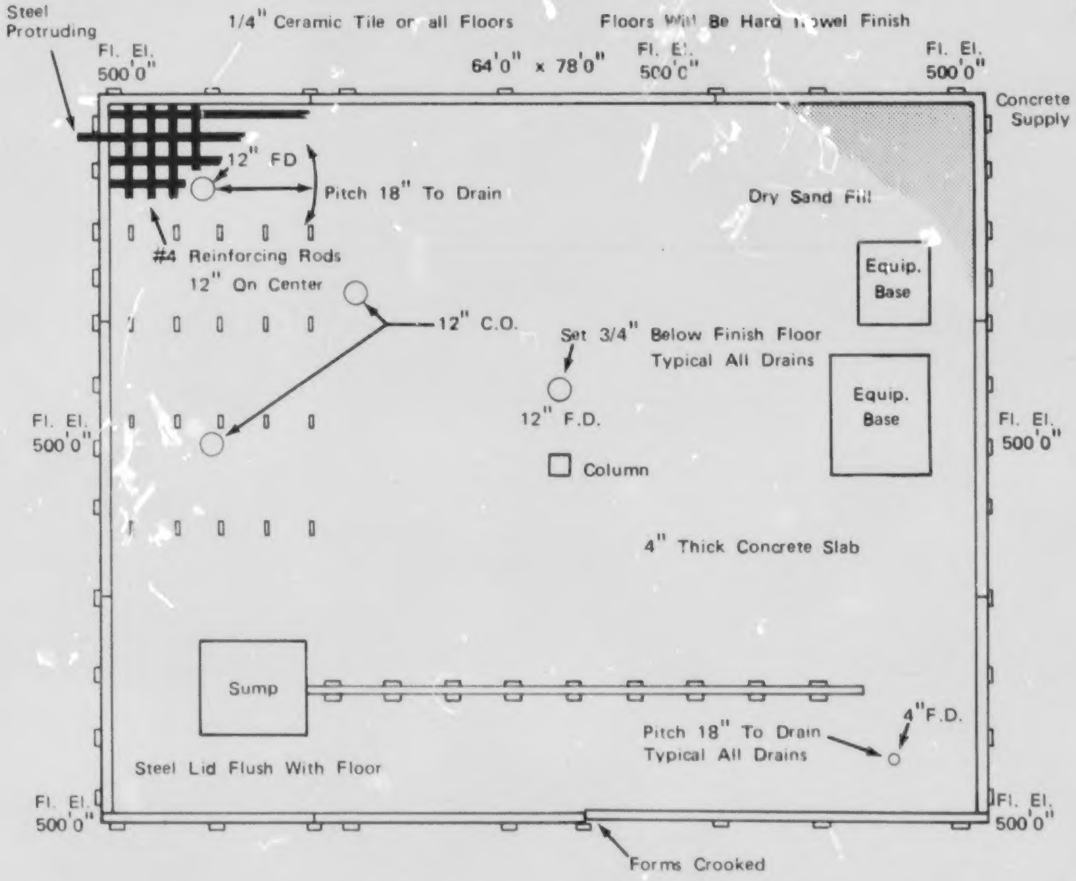
4. ______________________________

PLACING AND RODDING CONCRETE
UNIT III

ASSIGNMENT SHEET #3--INSPECT JOB AND COMPLETE CHECKLIST

Using job specifications below, answer the following questions.

1. Is subgrade proper (on grade)?
2. Does subgrade need wetting down?
3. Are forms set correctly and adequately braced?
4. Is steel protruding or burning forms?
5. How many obstacles are there to work around?
6. How much fall and pitch are at drains?
7. What type of finish is specified?
8. Will floor covering be used and, if so, how much will you hold down around drains and cleanouts?


Steel Protruding
1/4" Ceramic Tile on all Floors
Floors Will Be Hard Trowel Finish
Fl. El. 500'0"
64'0" x 78'0"
Fl. El. 500'0"
Fl. El. 500'0"
Concrete Supply
12" FD
Pitch 18" To Drain
Dry Sand Fill
#4 Reinforcing Rods 12" On Center
Equip. Base
12" C.O.
Set 3/4" Below Finish Floor Typical All Drains
Equip. Base
Fl. El. 500'0"
12" F.D.
Fl. El. 500'0"
Column
4" Thick Concrete Slab
Sump
4" F.D.
Pitch 18" To Drain Typical All Drains
Steel Lid Flush With Floor
Fl. El. 500'0"
Fl. El. 500'0"
Forms Crooked

PLACING AND RODDING CONCRETE
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. c
2. e

Assignment Sheet #2

1. Spirit level
2. String line
3. Builder's level
4. Boning rod

Assignment Sheet #3

1. Yes
2. Yes
3. No
4. Yes
5. 9
6. 3/4" - 18"
7. Hard trowel finish
8. Yes, 1/4"

PLACING AND RODDING CONCRETE
UNIT III

TEST

1. Match the terms on the right to the correct definitions.

_____a. Tool used to determine horizontal plane (level)

_____b. Steel that is touching forms

_____c. String used as a guide in setting forms

_____d. Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels

_____e. Set of any three rods of exact length used to sight across to establish a grade

_____f. Joints where one section has hardened before adjoining section has been poured

_____g. Soil prepared and compacted to support a structure or pavement system

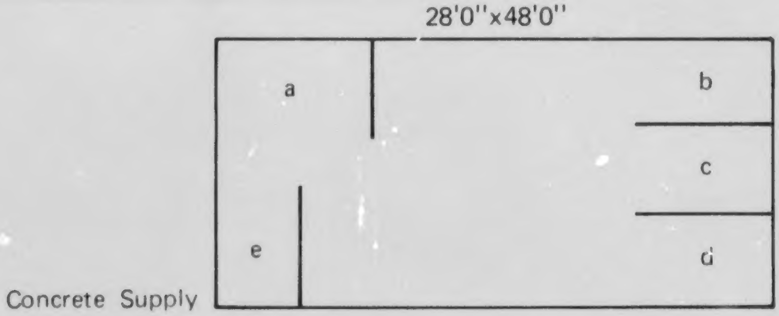
1. Boning rod
2. Builder's level
3. Cold joints
4. Spirit level
5. String line
6. Burning forms
7. Subgrade

2. Distinguish between placing and rodding by circling the letter pertaining to rodding.

   a. Process of delivering concrete from the supply and pouring it at the established area inside the forms

   b. Process of dragging off concrete to a specific grade

3. From the drawing below, circle the letter that indicates correct location to start the pour.

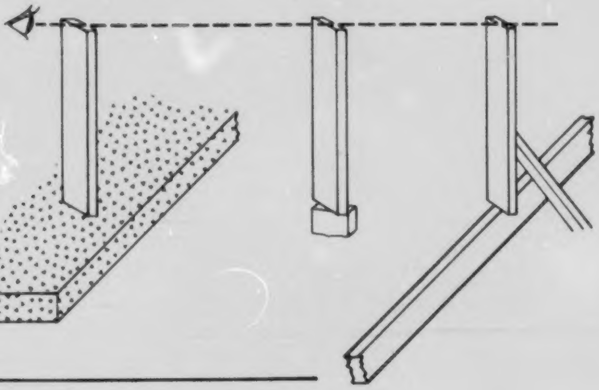


4. State two reasons subgrade should be moist previous to pour.

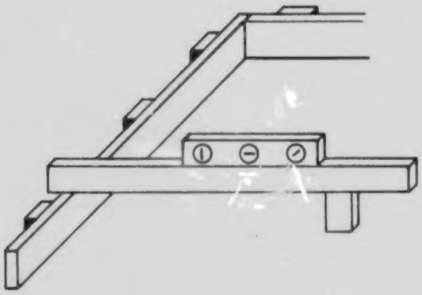
a.

b.

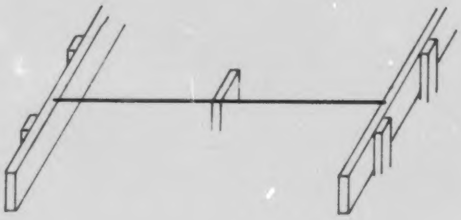
5. Identify different methods of leveling by filling in the blanks.



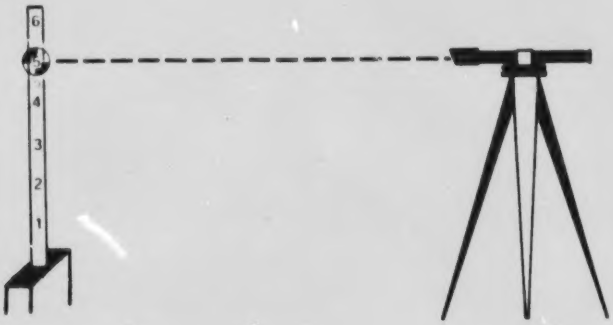
a. ______________________________



b. ______________________________

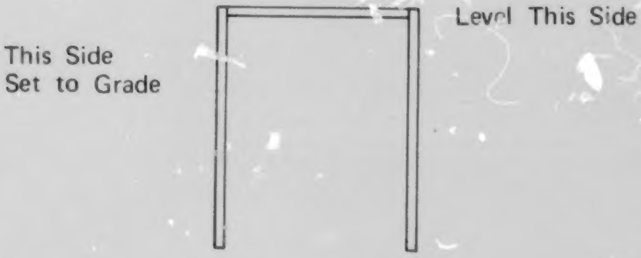


c. ______________________________



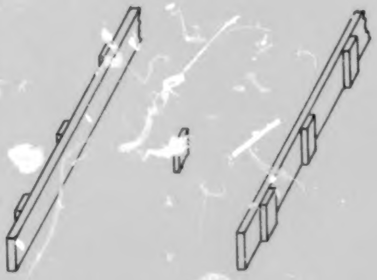
d. ______________________________

6. Name the method of leveling for each job below, using all four methods in test question five.


This Side
Set to Grade
Level This Side

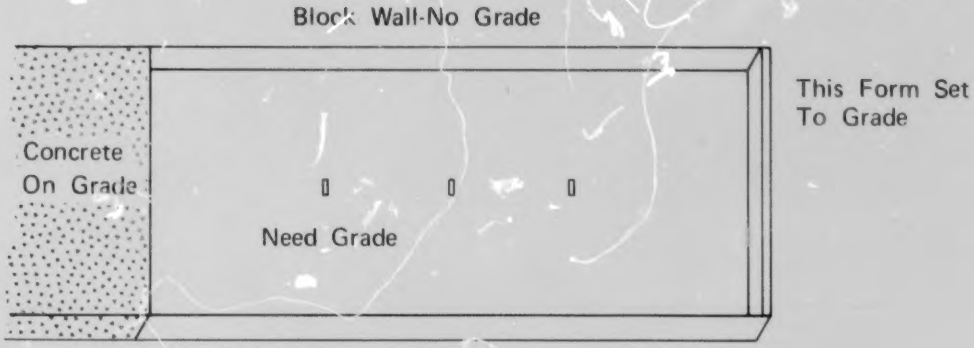
Side Walk 4' Wide

a. ____________________



Slab 21' Across
Both Forms Set to Grade

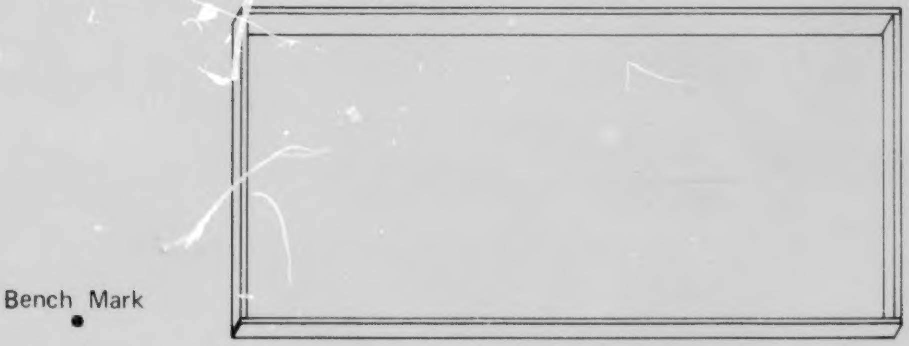
b. ____________________


Block Wall-No Grade
This Form Set
To Grade
Concrete
On Grade
Need Grade

32'0"x80'0"

c. ____________________

43'0"x96'0"



Need Grades to Set These Forms

d. ____________________

7. Inspect a job and complete a checklist.

(NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

PLACING AND RODDING CONCRETE
UNIT III

ANSWERS TO TEST

1. a. 4

   b. 6

   c. 5

   d. 2

   e. 1

   f. 3

   g. 7

2. b

3. b

4. Any two of the following are acceptable.

   a. To prevent absorption

   b. To prevent early set

   c. To keep down the temperature of the concrete

5. a. Boning rod

   b. Spirit level

   c. String line

   d. Builder's level

6. a. Spirit level

   b. String line

   c. Boning rod

   d. Builder's level

7. Evaluated to the satisfaction of the instructor.

CEMENT MASON'S
PROGRESS CHART

Section D
Placing

	UNIT I Builder's Level			UNIT II Screeds and Bulkheads									UNIT III Placing and Rodding Concrete							
	1	2	3	1	2	3	4	5	6	7	8	9	1	2	3					
Job **Student's Name**	UNIT TEST	Set Up and Adjust Builder's Level		UNIT TEST	Set Bulkheads for 4" Slab	Set Wet Pads with String Line	Set Wet Pads with Builder's Level and Rod	Set Pipe Screeds with Builder's Level and Rod	Set Grade Stakes Using Builder's Level	Set Grade Stakes Using a String Line	Set Grade Stakes Using a Spirit Level and Straightedge	Set Adjustable Screed Chairs Using Builder's Level	UNIT TEST							
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy	85% Correct	Within 1/100 of a foot @ 50'		85% Correct	Grade ± 1/8" Square ± 1/4" Alignment 1/4" @ 50' Adequate Bracing	± 1/8"	± 1/8"	± 1/8"	± 1/8"	± 1/8"	± 1/8"	± 1/8"	85% Correct							
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

EDGE FORMS ON GRADE
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match edge form terms to the definitions. He should be able to identify the parts of edge forms, name types of pours on which edge forms are used, and name three types of edge forms. He should be able to construct edge forms. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match a list of edge form terms to the correct definitions.
2. Identify the parts of an edge form.
3. Name six types of pours on which edge forms are used.
4. Name three types of edge forms.
5. Demonstrate the ability to:
    a. Construct edge forms for slab on grade without foundation.
    b. Construct forms for a slab on grade with foundation.
    c. Construct edge forms for a stoop.

EDGE FORMS ON GRADE
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Edge Form Without Wall

    2. TM 2--Edge Form with Wall

    3. TM 3--Types of Pours Using Edge Forms

    4. TM 4--Types of Pours Using Edge Forms (Continued)

        5. TM 5--Types of Forms

        6. TM 6--Types of Forms (Continued)

    D. Job sheets

        1. Job Sheet #1--Construct Edge Forms for a Slab on Grade Without Foundation

        2. Job Sheet #2--Construct Forms for a Slab on Grade with Foundation

        3. Job Sheet #3--Construct Edge Forms for a Stoop

    E. Test

    F. Answers to test

II. References:

A. Burke, Arthur E., J. Ralph Dalzell, and Gilbert Townsend. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction*. Englewood Cliffs: Prentice Hall, Inc., 1967.

C. Peurifoy, R. L. *Formwork for Concrete Structures*. McGraw Hill, Inc., 1964.

D. *Concrete Form Construction*. Albany, New York: Delmar Publications.

EDGE FORMS ON GRADE
UNIT I

INFORMATION SHEET

I. Terms and definitions

  A. Edge form--Low form placed at the perimeter of a slab

  B. Brace and/or kicker--Piece of wood or other material that directs, resists, or supports weight or pressure

  C. Spreader--Piece of wood that is used to hold the sides of the form apart and removed as the concrete is poured; may also be an integral part of the form tie

  D. Scab--Piece of material nailed across a splice to strengthen and hold it together

  E. Duplex nail--Double headed nail used in forming and designed for easy removal

  F. Foundation--That portion of a wall, including the footing, upon which the building rests

  G. Grade point--Level of the finished concrete in a form

  H. Monolithic pour--Continuous mass of concrete cast as a single unit

  I. Sheathing--Wood or metal that makes up the face of the form

  J. Stake--Piece of wood or metal pointed on one end and used to hold forms in place

  K. Expansion material--Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

  L. Expansion joint--Type of isolation joint

  M. Isolation joint--Joint to isolate one section of concrete from another and to isolate concrete from other rigid objects

  N. String line--String used as a guide when setting forms

  O. Screed--Stake, wet pad, or piece of wood or pipe used as a guide for leveling or grading a concrete slab

  P. Hardboard--Composition board made by compressing shredded wood chips often with a binder at high temperatures

  Q. Slab--Poured concrete floor

  R. Form oil--Manufactured product used on forms to prevent adhesion of concrete to the form

INFORMATION SHEET

II. Parts of an edge form (Transparencies 1 and 2)

- A. Stake
- B. Sheathing
- C. Brace and/or kicker
- D. Scab
- E. Duplex nail
- F. Block
- G. Support
- H. Spreader
- I. Tie wire

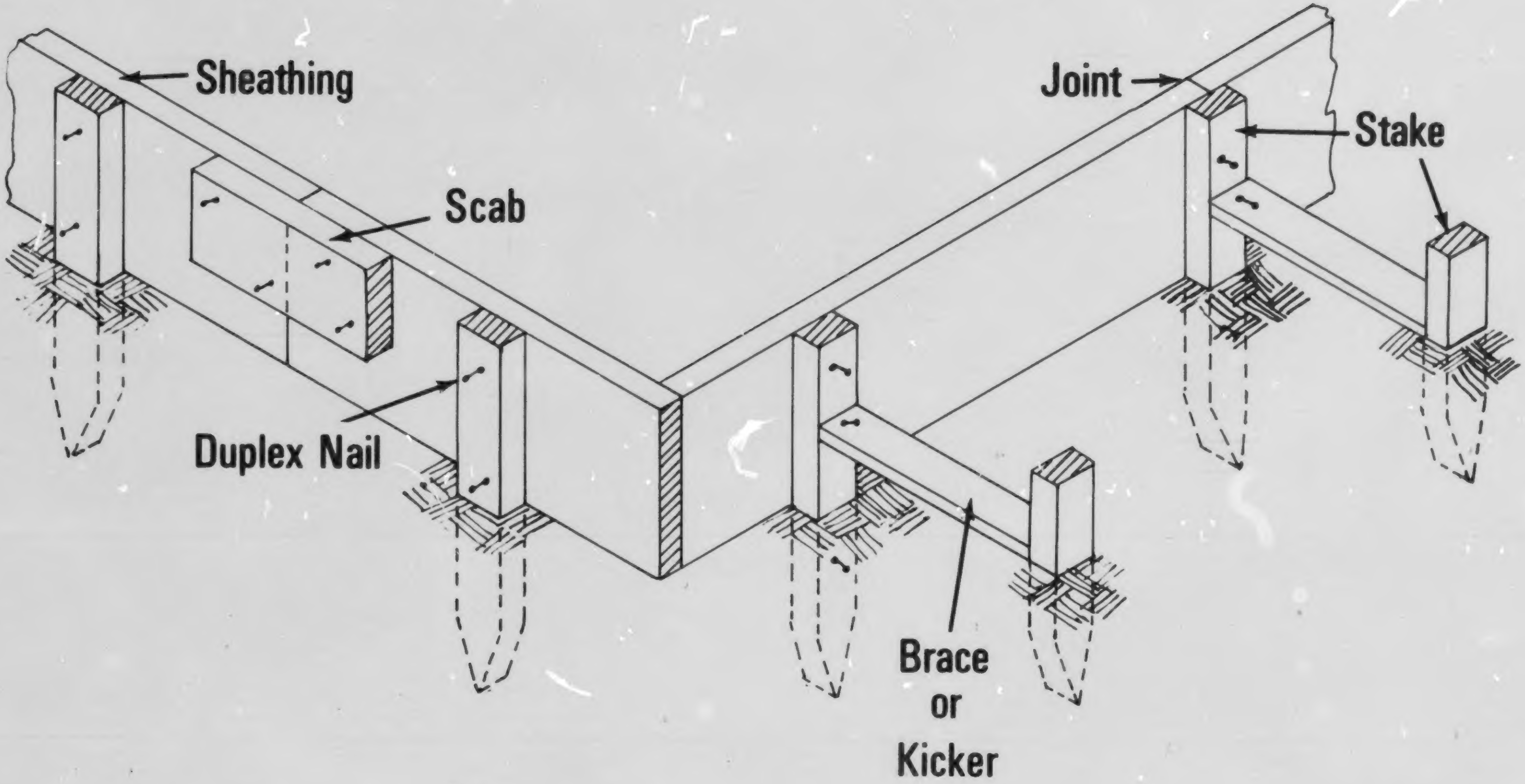
III. Types of pours using edge forms (Transparencies 3 and 4)

- A. Floor with foundation
- B. Floor without foundation
- C. Stoop
- D. Driveway
- E. Sidewalk
- F. Approach

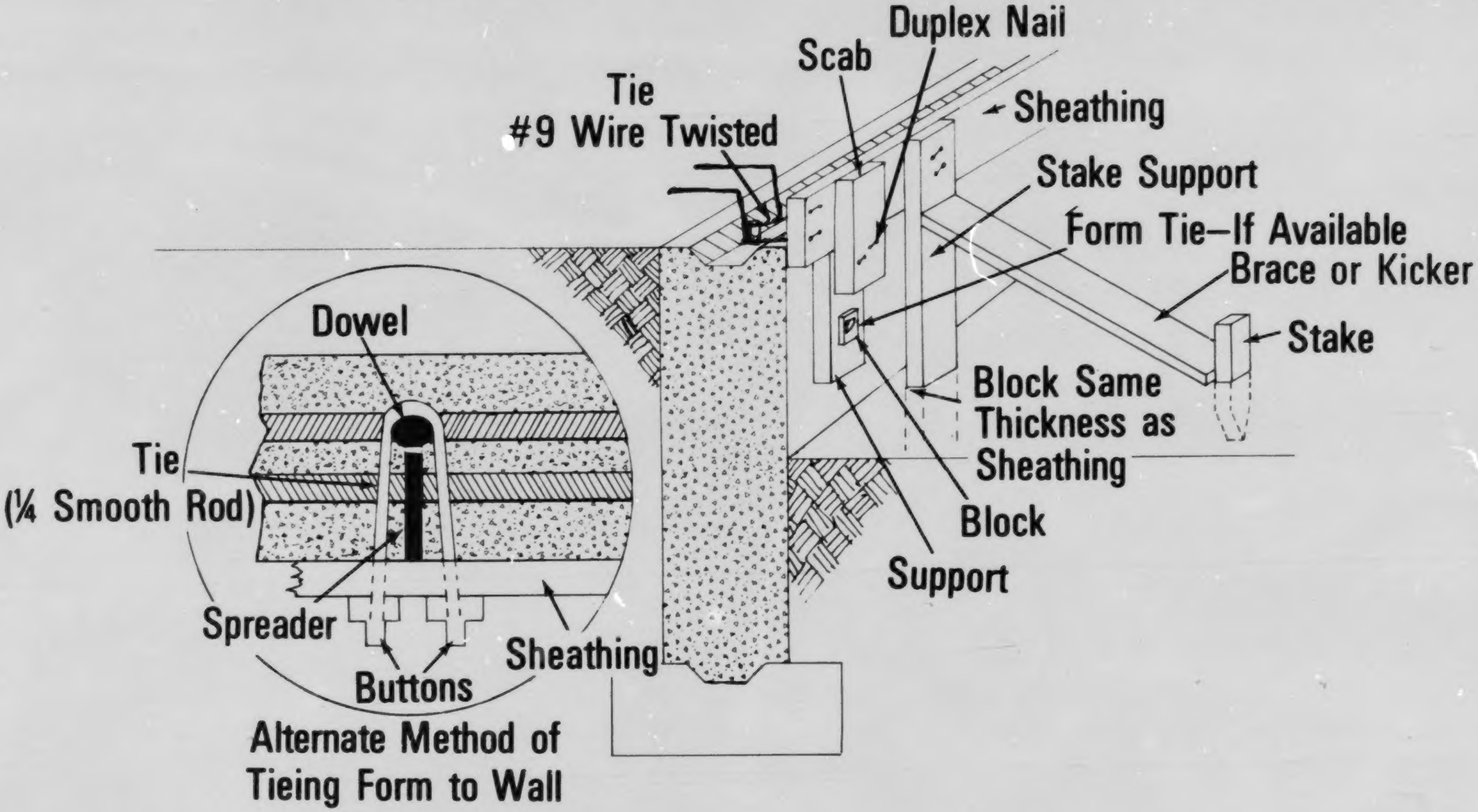
IV. Types of edge forms (Transparencies 5 and 6)

- A. Wood
- B. Metal
- C. Combination of wood and metal
- D. Hardboard

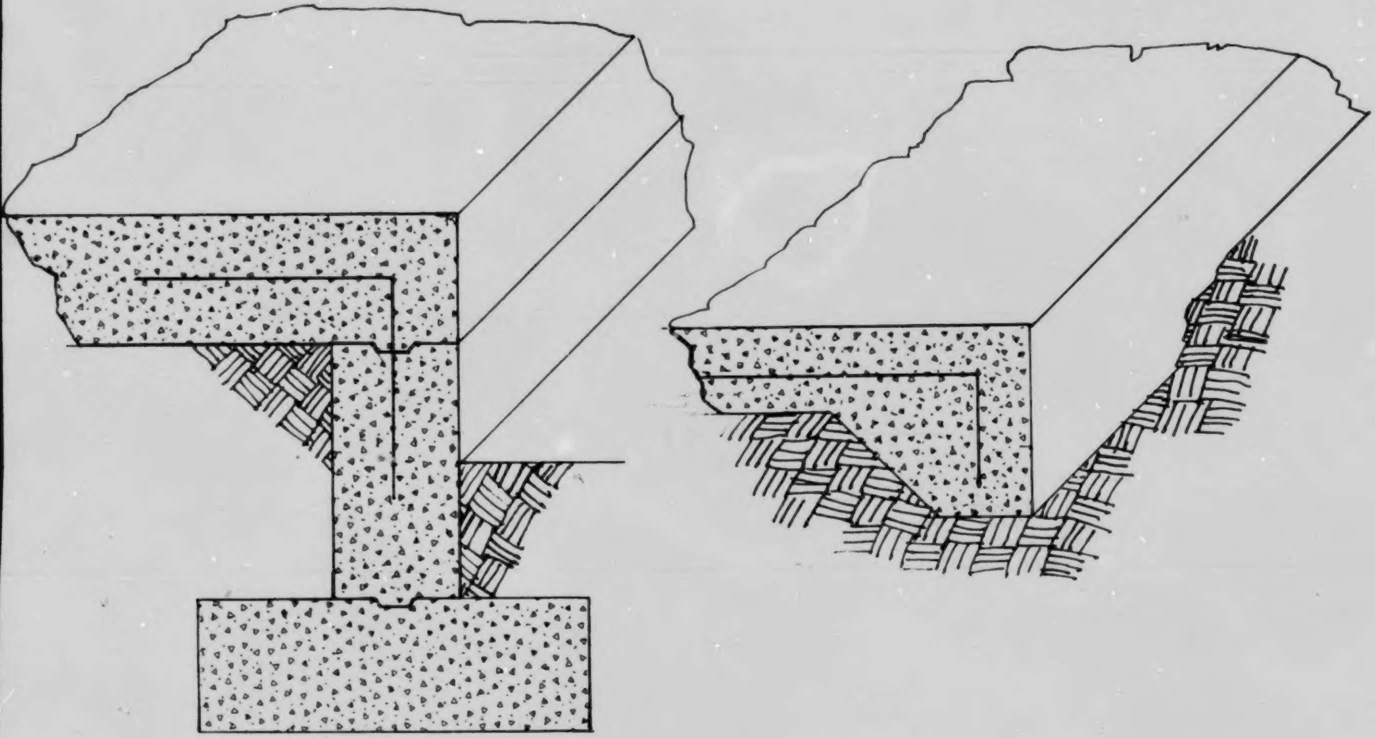
Edge Form Without Wall


Sheathing
Joint
Stake
Scab
Duplex Nail
Brace or Kicker

Edge Form with Wall


Tie
#9 Wire Twisted
Scab
Duplex Nail
Sheathing
Stake Support
Form Tie—If Available
Brace or Kicker
Stake
Block Same Thickness as Sheathing
Block
Support
Dowel
Tie (¼ Smooth Rod)
Spreader
Buttons
Sheathing
Alternate Method of Tieing Form to Wall

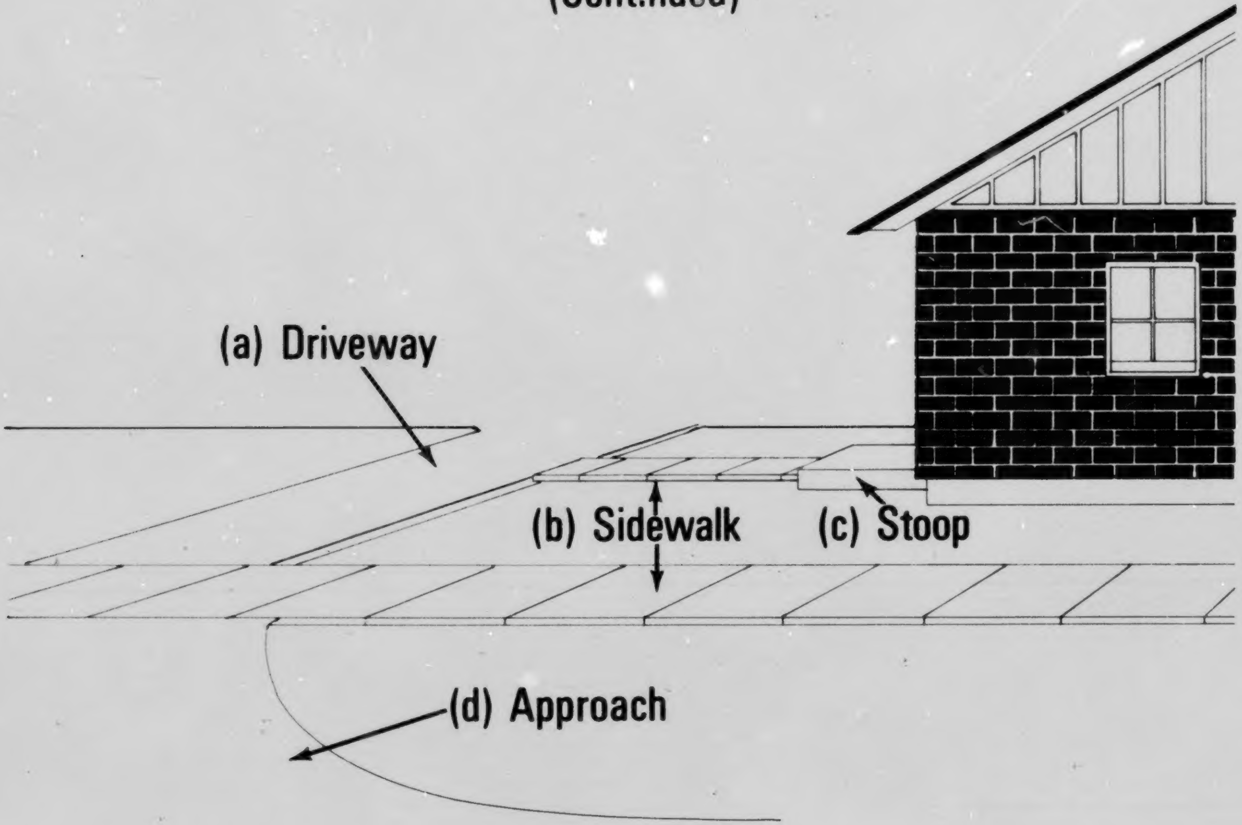
Types of Pours Using Edge Forms



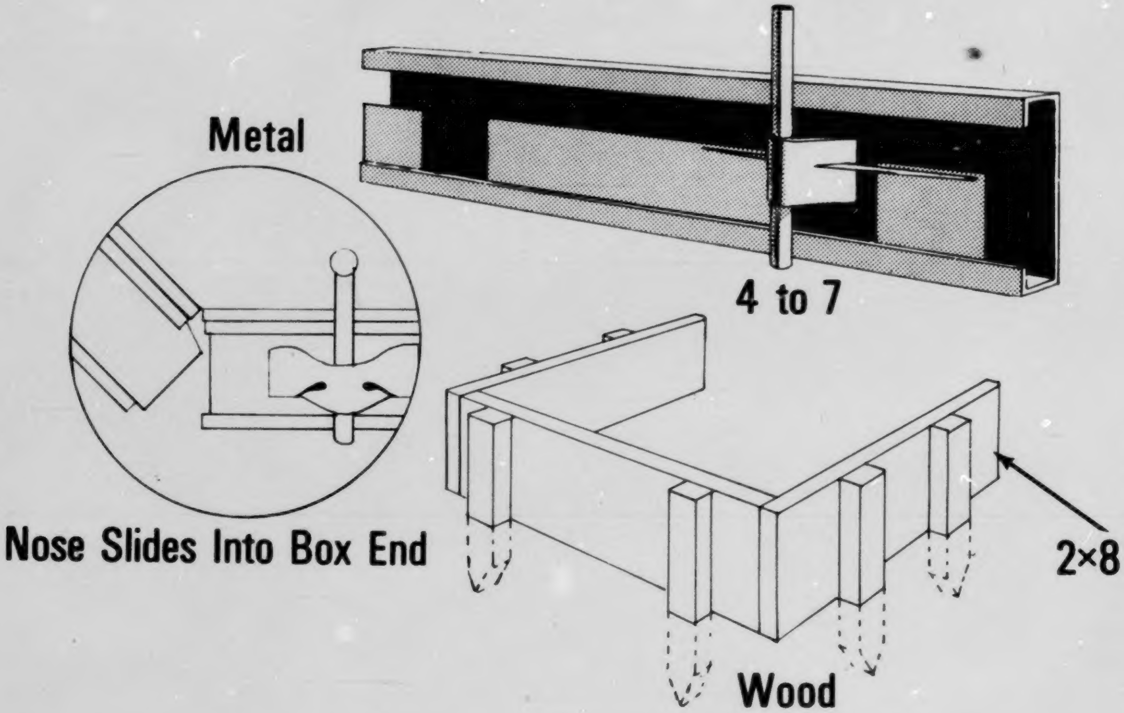
(a) Floor With Foundation (b) Floor Without Foundation

Types of Pours Using Edge Forms

(Continued)

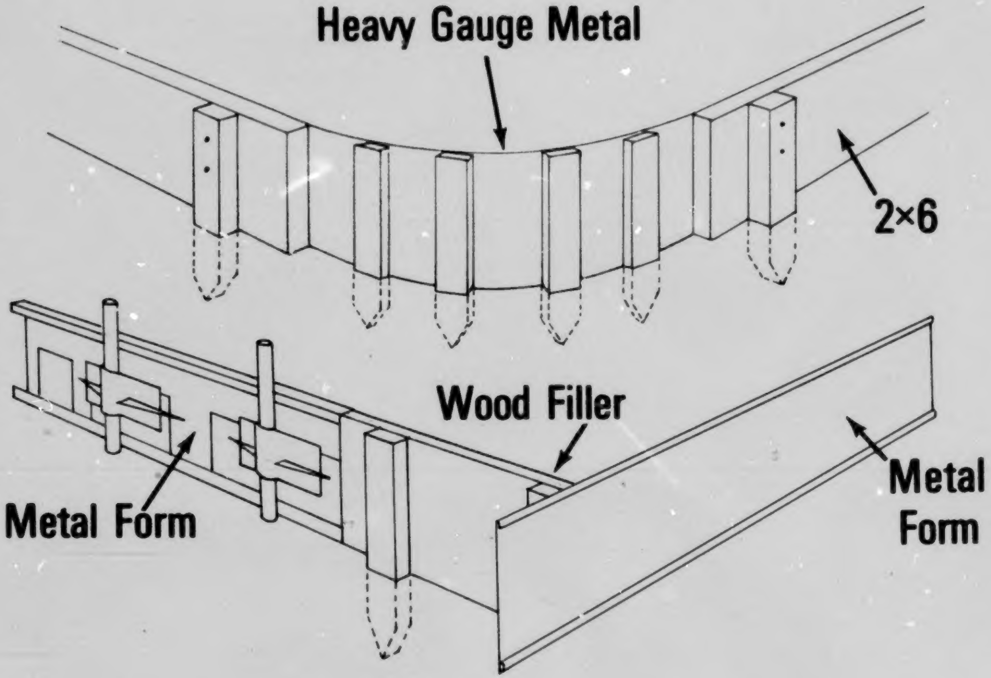

(a) Driveway
(b) Sidewalk
(c) Stoop
(d) Approach

Types of Forms


Metal
4 to 7
Nose Slides Into Box End
2×8
Wood

Types of Forms

(Continued)


Heavy Gauge Metal
2×6
Wood Filler
Metal Form
Metal Form

Combination Metal & Wood

EDGE FORMS ON GRADE
UNIT I

JOB SHEET #1--CONSTRUCT EDGE FORMS FOR A SLAB ON GRADE WITHOUT FOUNDATION

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer (16 ounce or larger)
3. Electric handsaw
4. Crosscut handsaw
5. 100 foot tape measure
6. Twelve or sixteen foot tape measure
7. Level (hand)
8. Chalkline and reel
9. Builder's level and rod
10. Plumb bob
11. String line

B. Materials

1. Stakes
2. 2 x 10's for sheathing
3. Nails
    a. 16d Duplex
    b. 8d Duplex

II. Procedure

A. Secure line to batter boards establishing four sides of the building

JOB SHEET #1

B. Attach plumb bob to line intersections (Figure 1)

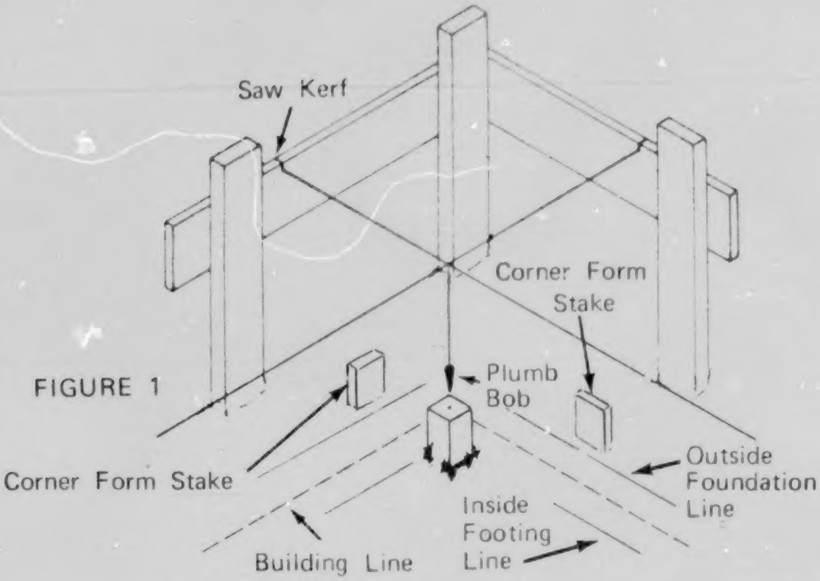

Saw Kerf
Corner Form Stake
Plumb Bob
Corner Form Stake
Outside Foundation Line
Inside Footing Line
Building Line

FIGURE 1

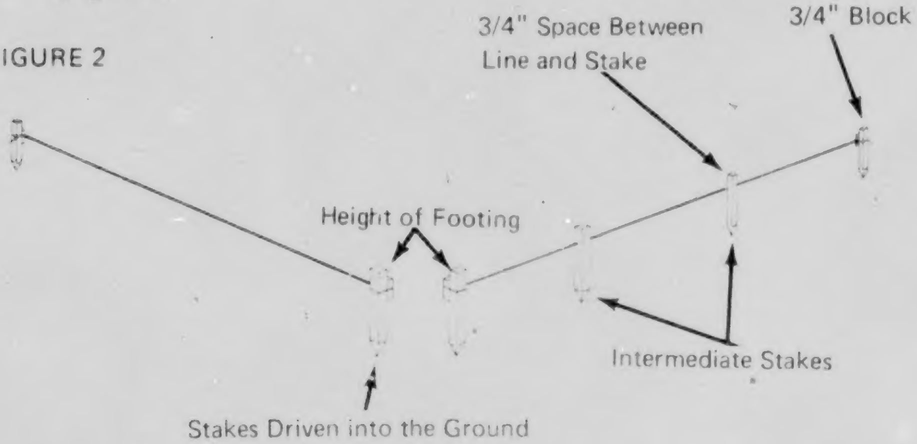
C. Drive corner form stakes

(NOTE: Allow 1 5/8" sheathing on outside of concrete line. See Figure 1.)

D. Repeat steps B and C on the other three corners

E. Stretch a string line between corner stakes and drive the intermediate stakes (Figure 2)

FIGURE 2


3/4" Space Between Line and Stake
3/4" Block
Height of Footing
Intermediate Stakes
Stakes Driven into the Ground

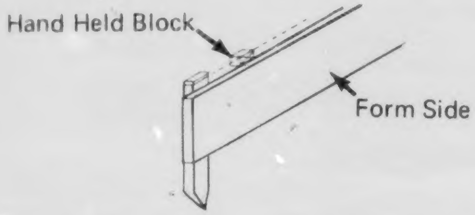
JOB SHEET #1

F. Establish the grade elevation on all corner stakes

G. Secure a string line 3/4 inch above mark to gauge height of sheathing (NOTE: Material of any thickness may be used for a gauge block.)

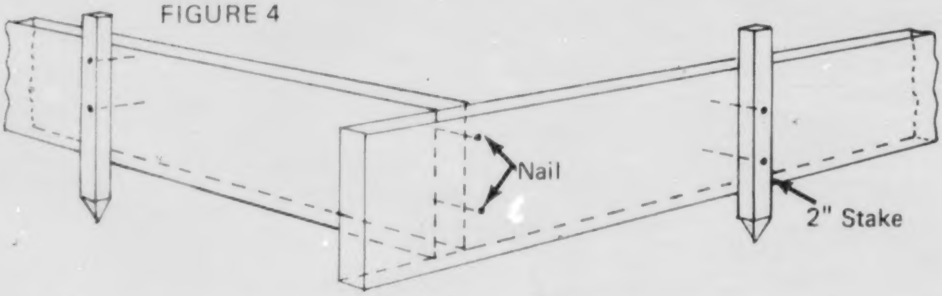
H. Nail sheathing to stakes using a 3/4" gauge block (Figure 3) (NOTE: Sight string line to be sure it has not sagged.)

FIGURE 3


Hand Held Block
Form Side

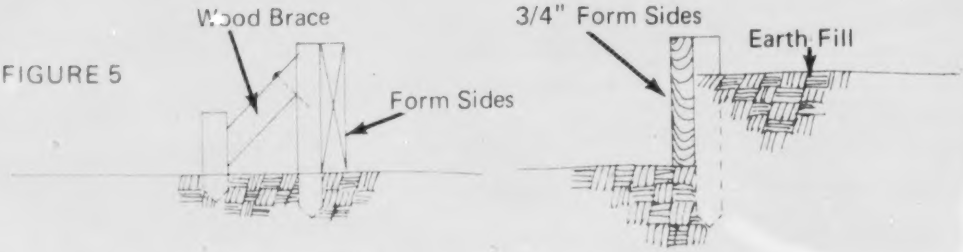
I. Tie all corners together as shown (Figure 4)

FIGURE 4


Nail
2" Stake

J. Brace the forms by one of the methods shown (Figure 5)

FIGURE 5


Wood Brace
Form Sides
3/4" Form Sides
Earth Fill

JOB SHEET #1

K. Make grade board as shown (Figures 6 and 7)

(NOTE: On wide buildings, it will be necessary to set a temporary screed. See Figure 7.)

FIGURE 6

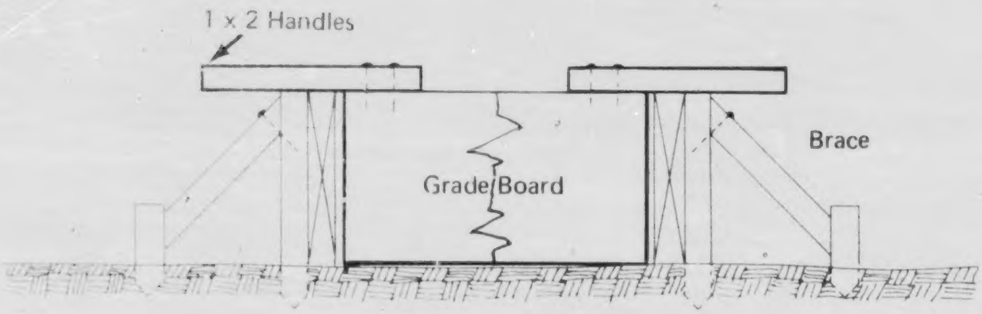
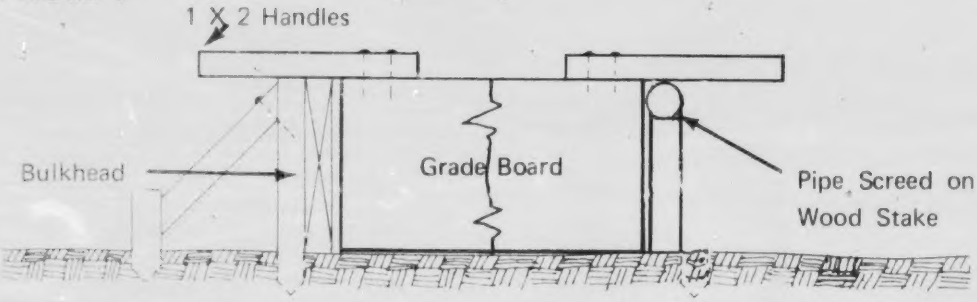

1 x 2 Handles
Brace
Grade Board

FIGURE 7


1 X 2 Handles
Bulkhead
Grade Board
Pipe Screed on Wood Stake

L. Apply form oil after forms are complete

EDGE FORMS ON GRADE
UNIT I

JOB SHEET #2--CONSTRUCT FORMS FOR A SLAB ON GRADE WITH FOUNDATION

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer (16 ounce or larger)
3. Electric handsaw
4. Crosscut handsaw
5. 100 foot tape measure
6. Twelve or sixteen foot tape measure
7. Level (hand)
8. String line
9. Chalkline
10. Builder's level and rod
11. Pliers
12. Form oil

B. Materials

1. Stakes
2. Sheathing
3. Nails
    a. 16d Duplex
    b. 8d Duplex
4. #9 annealed wire

II. Procedure

A. Lay sheathing on top of the wall or on the ground

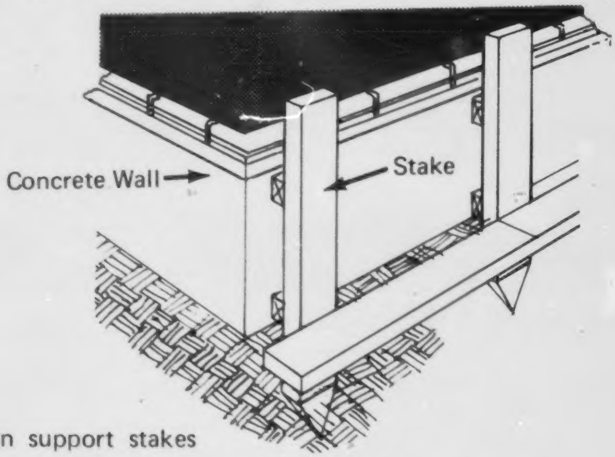
(NOTE: This is to establish location of support stakes.)

JOB SHEET #2

B. Drive support stakes at ends of each sheathing board (Figure 1)

(NOTE: Place a spacer block between the stake and the wall, holding the stake tightly against the spacer block while driving. When driven, the top of the stake should be above the finish slab grade.)

FIGURE 1



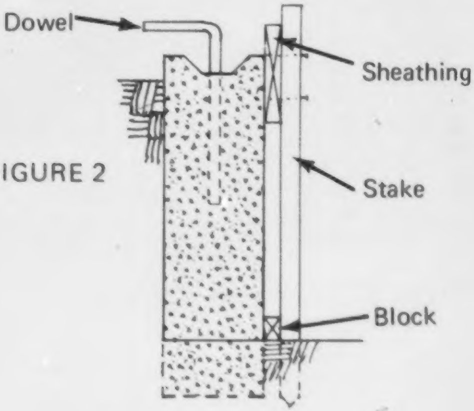
C. Establish grade on support stakes

(NOTE: Use the builder's level and establish the grade from the bench mark.)

D. Nail sheathing to stakes (Figure 2)

(NOTE: Drive a nail on the inside of the sheathing, a little less than the height of the grade mark on the stake and the foundation. Set sheathing in position, raise sheathing to grade mark, and nail.)

FIGURE 2



JOB SHEET #2

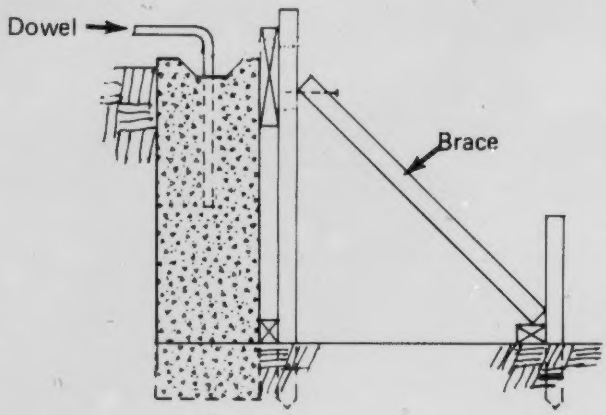
E. Drive intermediate stakes

F. Secure sheathing tight against the wall (Figures 3 and 4)

(NOTE: Figures 3 and 4 show alternate methods of holding the form against the wall and plumb. There could be situations where they would both be used on the same form.)

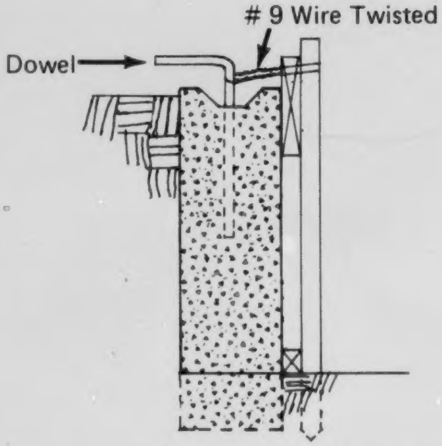
1. Brace

FIGURE 3



2. Tie

FIGURE 4



G. Cut stakes off flush with top of the edge form on surfaces where the straightedge will be pulled

H. Apply form oil after forms are set

EDGE FORMS ON GRADE
UNIT I

JOB SHEET #3--CONSTRUCT EDGE FORMS FOR A STOOP

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer (16 ounce or larger)
3. Electric handsaw
4. Crosscut handsaw
5. 100 foot tape measure
6. Twelve or sixteen foot tape measure
7. Level (hand)
8. Chalkline and reel
9. Builder's level and rod
10. String line

B. Materials

1. Stakes
2. 2 x 6 for sheathing
3. Nails
    a. 6d box
    b. 8d Duplex
4. 1/4" hardboard

II. Procedure

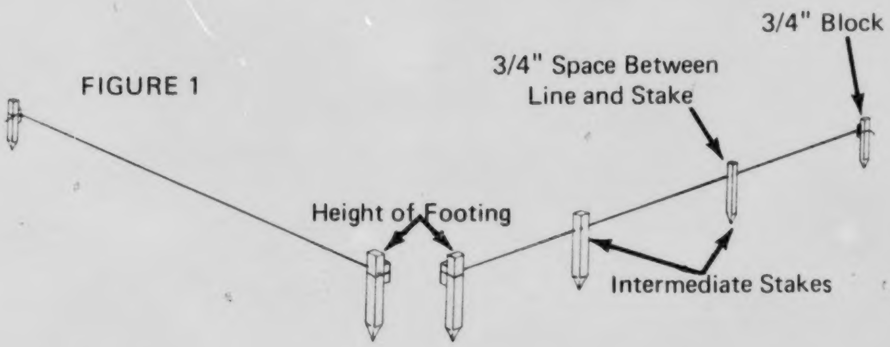
A. Establish a grade line using the builder's level

(NOTE: Stoops should slope from the building.)

JOB SHEET #3

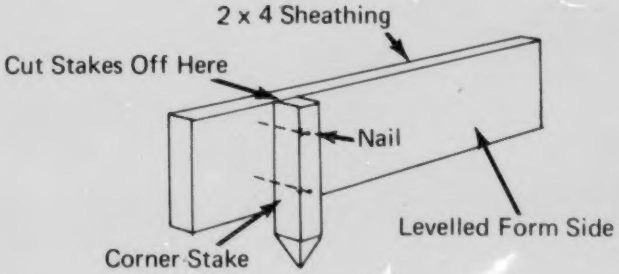
B. Drive corner and radius stakes, stretch a string line between corner stakes, and drive the intermediate stakes (Figure 1)

FIGURE 1


3/4" Block
3/4" Space Between Line and Stake
Height of Footing
Intermediate Stakes

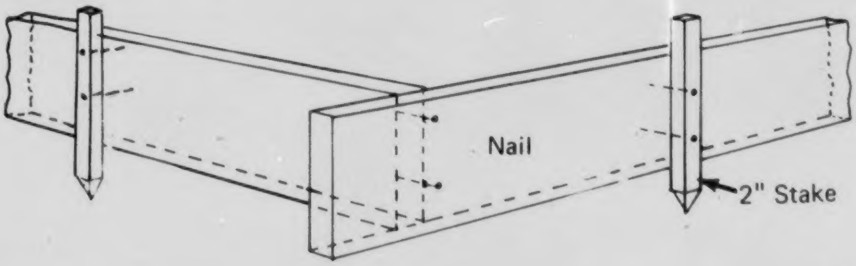
C. Nail 2 x 4 sheathing to stakes (Figure 2)

FIGURE 2


2 x 4 Sheathing
Cut Stakes Off Here
Nail
Levelled Form Side
Corner Stake

D. Tie the corners together as illustrated (Figure 3)

FIGURE 3


Nail
2" Stake

JOB SHEET #3

E. Set forms for curved sections with five foot radius (Figure 4)

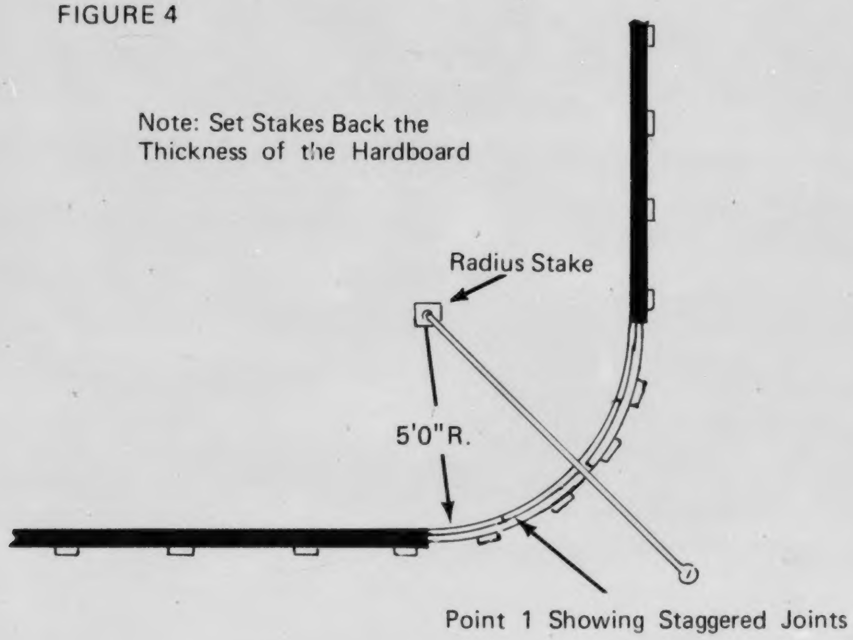
1. Cut 1/4 inch hardboard into strips the thickness of the concrete slab

2. Hook tape on nail in radius stake

3. Drive stakes on radius line (Figure 4)

   (NOTE: Set stake back the thickness of the hardboard. With this radius, we will use two thicknesses of 1/4 inch material with staggered joints. See Figure 4, Point 1.)

FIGURE 4


Note: Set Stakes Back the Thickness of the Hardboard
Radius Stake
5'0"R.
Point 1 Showing Staggered Joints

4. Nail hardboard to stakes

   a. Hold the two pieces of hardboard flush on top and start nailing at one end

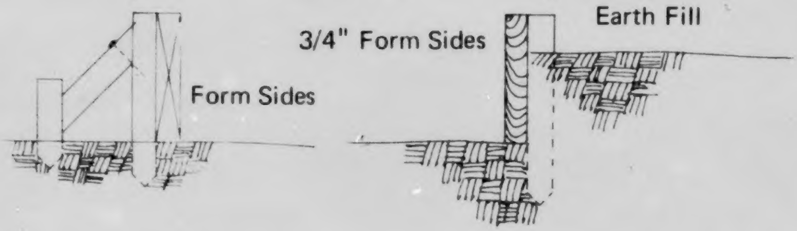
   b. Proceed to add pieces and nail to stakes until curve is complete

      (NOTE: If joints miss stakes, drive another stake.)

JOB SHEET #3

F. Brace the forms by one of the methods shown (Figure 5)

FIGURE 5


Form Sides
3/4" Form Sides
Earth Fill

G. Apply form oil after forms are set

EDGE FORMS ON GRADE
UNIT I

TEST

1. Match the terms on the right to the correct definitions. Place the correct numbers in the blanks provided.

_____a. Low form placed at the perimeter of a slab

_____b. Piece of wood or other material that directs, resists, or supports weight or pressure

_____c. Double headed nail used in forming and designed for easy removal

_____d. That portion of a wall, including the footing, upon which the building rests

_____e. Level of the finished concrete in a form

_____f. Continuous mass of concrete cast as a single unit

_____g. Wood or metal that makes up the face of the form

_____h. Piece of wood or metal pointed on one end and used to hold forms in place

_____i. Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

_____j. Poured concrete floor

_____k. Stake, wet pad, or piece of wood or pipe used as a guide for leveling or grading a concrete slab

_____l. Type of isolation joint

_____m. Joint to isolate one section of concrete from another and to isolate concrete from other rigid objects

1. Stake
2. Sheathing
3. Spreader
4. Slab
5. Brace and/or kicker
6. Expansion material
7. Scab
8. Duplex nail
9. Monolithic pour
10. String line
11. Edge form
12. Foundation
13. Hardboard
14. Grade point
15. Screed
16. Form oil
17. Isolation joint
18. Expansion joint

______n. Piece of wood that is used to hold the sides of the form apart and removed as the concrete is poured; may also be an integral part of the form tie

______o. Piece of material nailed across a splice to strengthen and hold it together

______p. String used as a guide when setting forms

______q. Composition board made by compressing shredded wood chips often with a binder at high temperatures

______r. Manufactured product used on forms to prevent adhesion of concrete to the form

2. Identify the nine parts of a form by placing the correct number in the blanks provided.

______a. Stake

______b. Sheathing

______c. Brace and/or kicker

______d. Scab

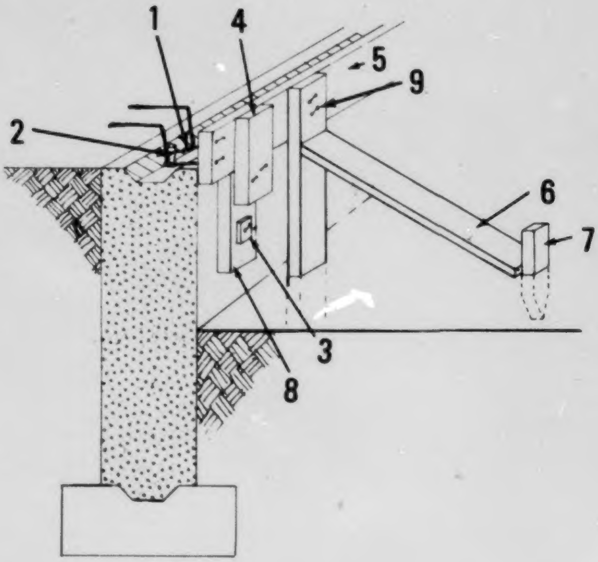
______e. Duplex nail

______f. Block

______g. Support

______h. Spreader

______i. Tie wire



3. Name six types of pours on which edge forms are used.

a.

b.

c.

d.

e.

f.

4. Name three types of edge forms.

   a.

   b.

   c.

5. Demonstrate the ability to:

   a. Construct edge forms for slab on grade without foundation.

   b. Construct forms for a slab on grade with foundation.

   c. Construct edge forms for a stoop.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

EDGE FORMS ON GRADE
UNIT I

ANSWERS TO TEST

1. a. 11
   b. 5
   c. 8
   d. 12
   e. 14
   f. 9
   g. 2
   h. 1
   i. 6
   j. 4
   k. 15
   l. 18
   m. 17
   n. 3
   o. 7
   p. 10
   q. 13
   r. 16

2. a. 7
   b. 5
   c. 6
   d. 4
   e. 9
   f. 3
   g. 8
   h. 2
   i. 1

3. a. Floor with foundation
   b. Floor without foundation
   c. Driveway
   d. Sidewalk
   e. Stoop
   f. Approach

4. Any three of the following are acceptable.
   a. Wood
   b. Metal
   c. Combination of wood and metal
   d. Hardboard
5. Performance skills evaluated to the satisfaction of the instructor

FINISHING CONCRETE FLOORS
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match special types of toppings to their uses. He should be able to arrange in order the steps to take when finishing a slab. He should be able to discuss why concrete is consolidated and what is meant by premature troweling. He should be able to demonstrate the ability to place and finish a concrete slab. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with finishing concrete floors to the proper definitions.
2. Match special types of toppings to their uses.
3. Select from a list five types of finishes for concrete floors.
4. Arrange in order the steps to take when placing and finishing a concrete slab.
5. Name four variables to consider before floating a slab.
6. Select from a list four factors to look for before finishing.
7. Discuss in a short paragraph the purpose for consolidating concrete.
8. Distinguish between rodding and jitterbugging.
9. State the reasons for floating a slab.
10. Discuss in a few words the reasons for troweling a slab.
11. Discuss in a few words what is meant by premature troweling.
12. Select from a list defects caused by premature and excessive finishing.
13. Demonstrate the ability to:
    a. Finish small slab with float finish.
    b. Finish large slab with float finish.
    c. Finish slab with rough broom finish.

d. Finish slab with hand trowel.

e. Finish slab with fine broom finish.

f. Finish slab using trowel machine.

g. Finish slab with swirl finish: Sweat trowel.

h. Place and prepare subbase slab for topping.

i. Finish slab using special type topping: Monolithic two course method.

j. Finish slab using special type topping: Monolithic dry shake method.

FINISHING CONCRETE FLOORS
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Discuss terminal and specific objectives.

  D. Discuss information sheet.

  E. Demonstrate and discuss procedures outlined in the job sheets.

  F. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Job sheets

    1. Job Sheet #1--Finish Small Slab with Float Finish

    2. Job Sheet #2--Finish Large Slab with Float Finish

    3. Job Sheet #3--Finish Slab with Rough Broom Finish

    4. Job Sheet #4--Finish Slab with Hand Trowel

5. Job Sheet #5--Finish Slab with Fine Broom Finish

6. Job Sheet #6--Finish Slab Using Trowel Machine

7. Job Sheet #7--Finish Slab with Swirl Finish: Sweat Trowel

8. Job Sheet #8--Place and Prepare Subbase Slab for Topping

9. Job Sheet #9--Finish Slab Using Special Type Topping: Monolithic Two Course Method

10. Job Sheet #10--Finish Slab Using Special Type Topping: Monolithic Dry Shake Method

D. Test

E. Answers to test

II. References:

A. *Concrete Technology: Instructor's Guide.* Skokie, Illinois: Portland Cement Association, 1965.

B. *Cement Mason's Manual for Residential Construction.* Skokie, Illinois: Portland Cement Association, 1960.

C. *Master Builders.* "Concrete Floor Products," June 1968.

FINISHING CONCRETE FLOORS
UNIT II

INFORMATION SHEET

I. Terms and definitions

   A. Slab--Poured concrete floor

   B. Rodding and/or dragging off--Process of straightedging or rodding concrete to a specific grade

   C. Jitterbugging--Process of consolidating or compacting concrete

   D. Darby--Tool used to level high spots and/or ridges left by straightedge

   E. Darbying--Process of leveling high spots and/or ridges left by straightedge

   F. Rollerbug--Tool used to consolidate or compact concrete

   G. Floating--Process of leveling out surface of concrete by cutting off high spots and filling low places

   H. Troweling--Process of leveling surface of concrete to a smooth, dense finish

   I. Edging--Process of smoothing and rounding the edges of concrete

   J. Subgrade--Soil prepared and compacted to support a structure or a pavement system

   K. Bleed water--Water that comes to the surface of concrete after the concrete has been placed

   L. Water sheen--Lustrous surface imparted by the evaporation of the bleed water

   M. Topping--Generally, a commercial mixture used to top floor surfaces to provide durability, safety, and beauty

   N. Fines--Material or paste worked to the surface

   O. Knee boards--Tool used to kneel on while finishing concrete

   P. Broom finish--Type of finish designed by running broom across the surface leaving grooves or pattern in concrete

   Q. Consistency--Slump (firmness or wetness) of fresh concrete

   R. Burnish finish--Process of troweling concrete to a very hard, smooth surface

INFORMATION SHEET

S. Swirl finish--Process of troweling concrete and leaving surface with a fuzzy fanlike pattern

T. Monolithic--Continuous mass of concrete cast as a single unit

U. Neat cement--Pure cement (without anything added)

V. Specifications--Detailed set of written instructions which explains the drawing, describes material and equipment used in the structure as to quality and types, and becomes part of the contract

W. Bonding agent--Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

X. Laitance--Film on surface of concrete

Y. Low slump--Stiff concrete

Z. Slurry--Very wet mixture of sand, cement, and water

AA. Shake--Application of a dry topping material

BB. Acid etch--Method of cleaning concrete by scrubbing with acid and rinsing with clear water

CC. Scarifier--Tool or machine used to chip the surface of concrete

II. Special types of concrete toppings and their uses

A. Abrasion resistant--Used where floors are subjected to high abrasion, usually in industrial plants

B. Impact resistant--Used primarily in heavy industry where the damage from impact is evident

C. Spark resistant (static disseminating)--Used in explosive manufacturing plants, aircraft hangers, hospital operating rooms, and other areas where static charges are dangerous

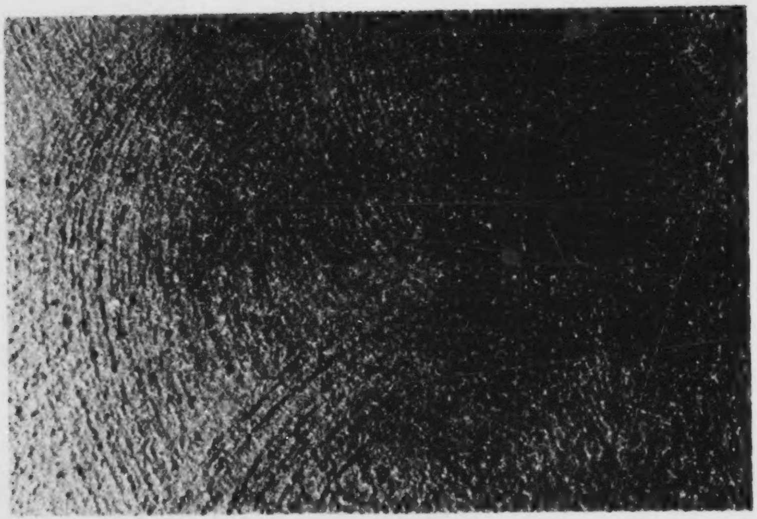
D. Vermin proof--Used mainly in institutions and hospitals

E. Colored--Used nearly anywhere to enhance the appearance of concrete; also used to mark off special areas, such as aisles and hazardous areas in industrial plants

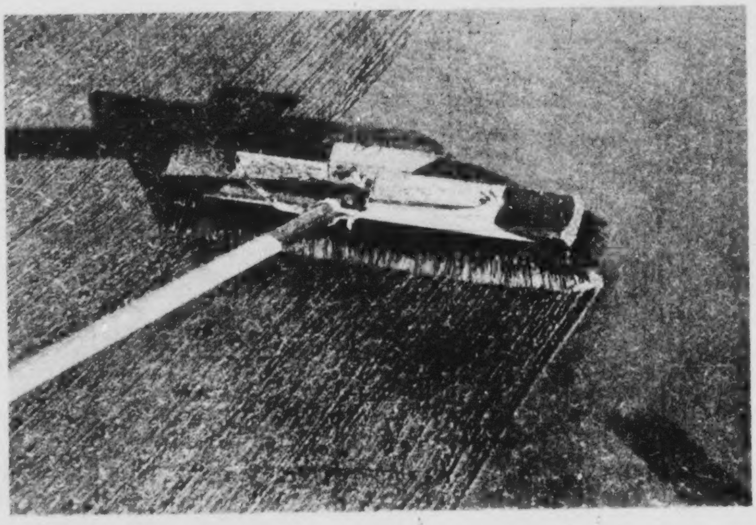
INFORMATION SHEET

III. Types of finishes for concrete floors

A. Float

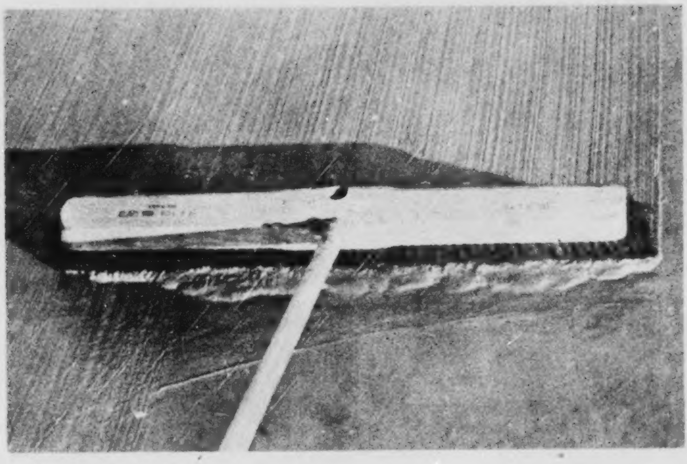


B. Rough broom



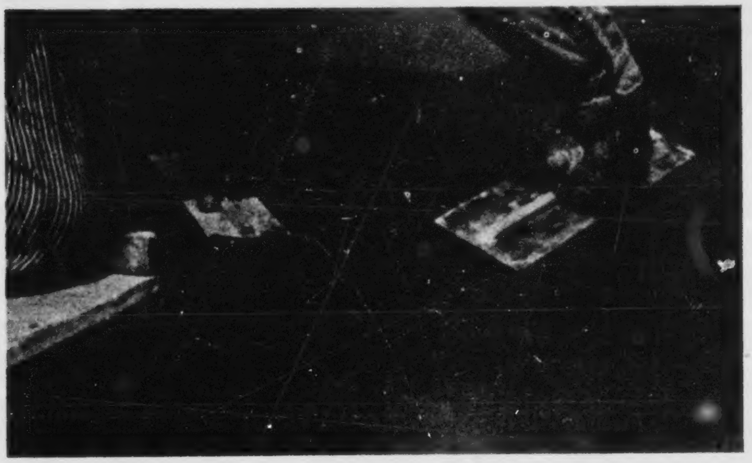
INFORMATION SHEET

C. Fine broom



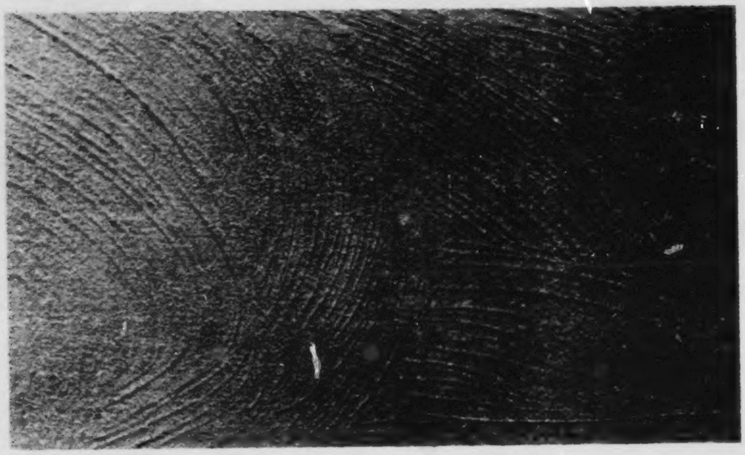
D. Hand trowel

(NOTE: A hand trowel finish defines any type of trowel finish, including very wet.)



INFORMATION SHEET

E. Swirl



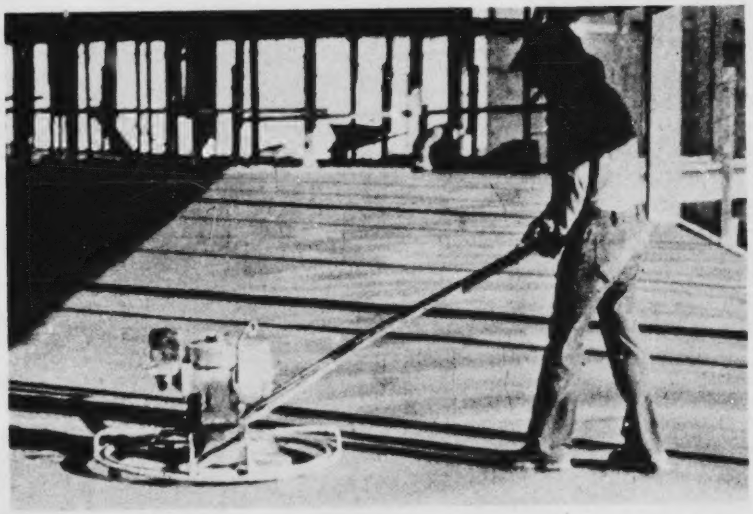
F. Hard trowel

(NOTE: A hard trowel finish is just as it implies, a hard trowel finish.)

G. Burnish

(NOTE: A burnish finish is a process of troweling concrete to a very hard, smooth finish.)

H. Machine



INFORMATION SHEET

IV. Steps to take when placing and finishing a concrete slab

  A. Rod (straightedge)

  B. Jitterbug or rollerbug

  C. Darby or bullfloat

  D. Hand float

  E. Edge

  F. Trowel

  G. Finish

V. Variables to consider before floating a slab

  A. Concrete temperature

  B. Air temperature

  C. Relative humidity

  D. Wind

  (NOTE: Experience is the only true measure for determining when to start floating a slab.)

VI. Factors to look for before finishing

  A. Concrete stiffening

    (NOTE: Concrete should be hard enough to support the weight of a man, leaving only slight impressions.)

  B. Bleed water gone

  C. Water sheen disappeared

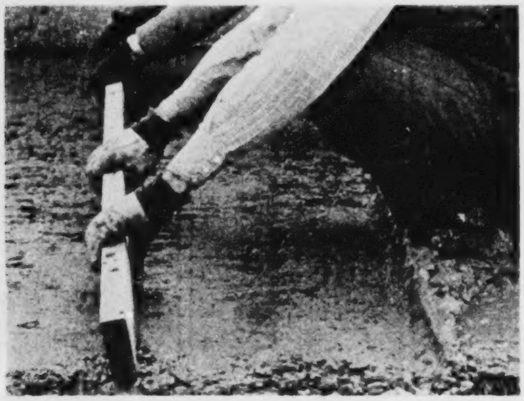
  D. Glossy appearance not noticeable

VII. Purpose for consolidating concrete--To provide a uniform dense mass without any air voids or stone pockets

INFORMATION SHEET

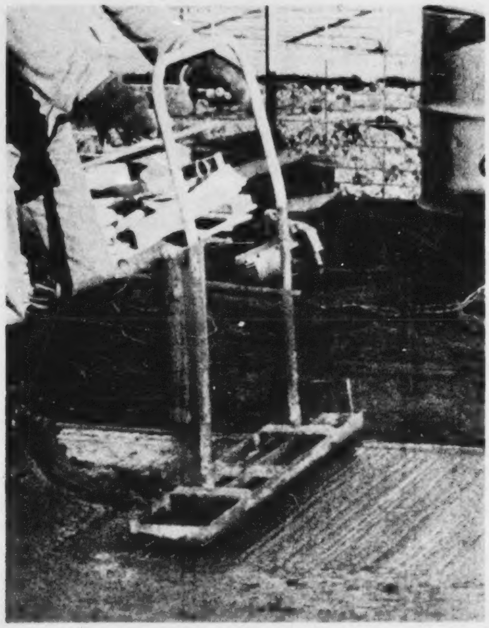
VIII. Rodding and jitterbugging

A. Rodding--Process of straightedging concrete to a specific grade



B. Jitterbugging--Process of consolidating or compacting concrete

(CAUTION: Jitterbugging or tamping of any type should be done sparingly to avoid excessive separation.)



INFORMATION SHEET

IX. Reasons for floating a slab

   A. Level out all imperfections

   B. Cut off high places

   C. Fill in low places

   D. Bring fines to the surface

X. Reasons for troweling a slab

   A. To bring surface to a smooth, dense finish

   B. To provide desired appearance, texture, and hardness that is specified

XI. Premature troweling--Starting to finish concrete before the water sheen has left the surface or before the concrete has hardened sufficiently

XII. Defects caused by premature and excessive finishing

   A. Dusting

   B. Crazing

   C. Scaling

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #1--FINISH SMALL SLAB WITH FLOAT FINISH

I. Tools and materials

  A. Tools

    1. 10' straightedge
    2. Two hand floats and/or one trowel
    3. Jitterbug
    4. Darby
    5. Edger with 1/4" radius
    6. Margin trowel
    7. Sprayer

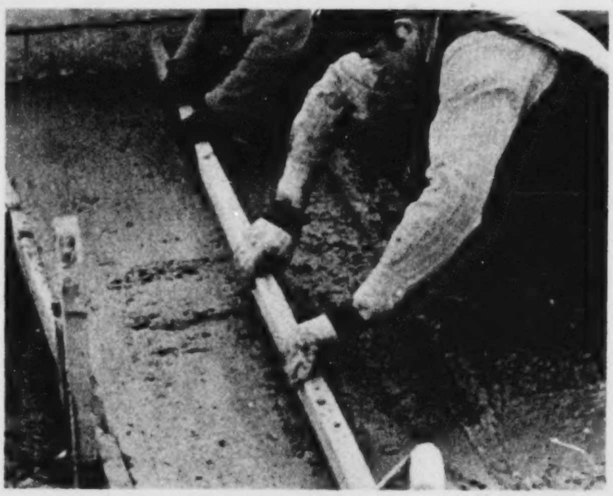
  B. Materials

    1. Concrete
    2. Curing agent

II. Procedure

  A. Place concrete at starting point (Figure 1)

FIGURE 1

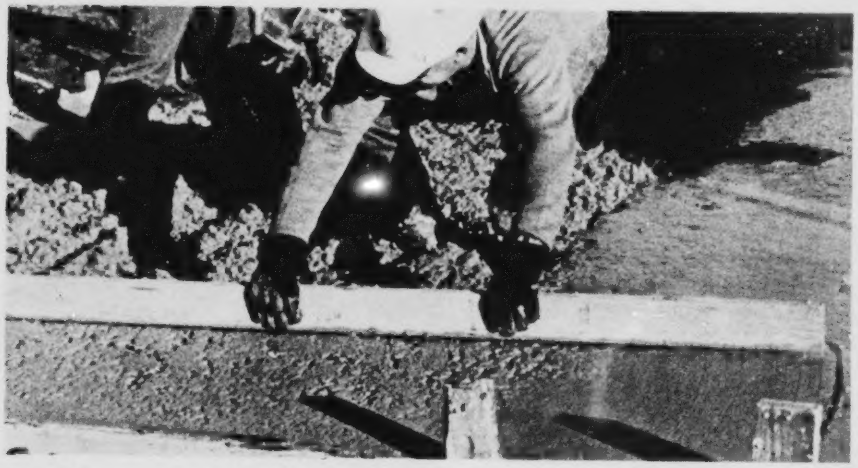


JOB SHEET #1

B. Use straightedge with a sawlike motion to rod concrete (Figure 2)

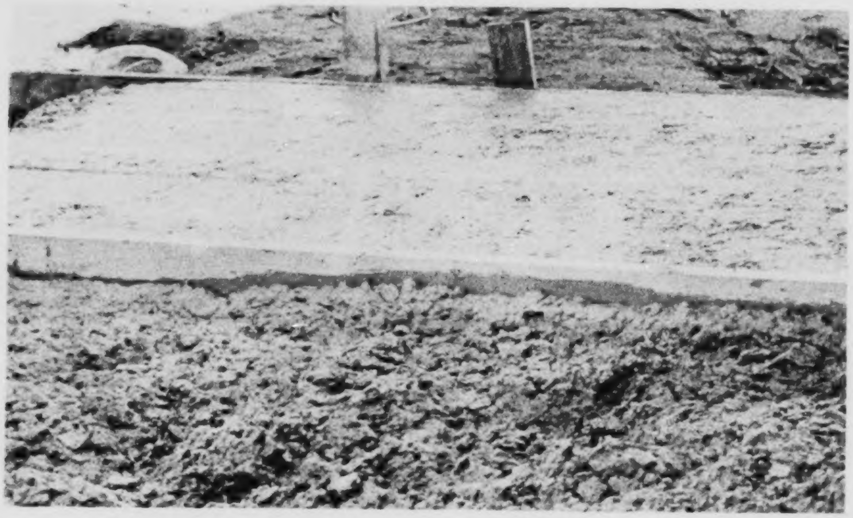
(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind the straightedge to fill holes. See Figure 3.)

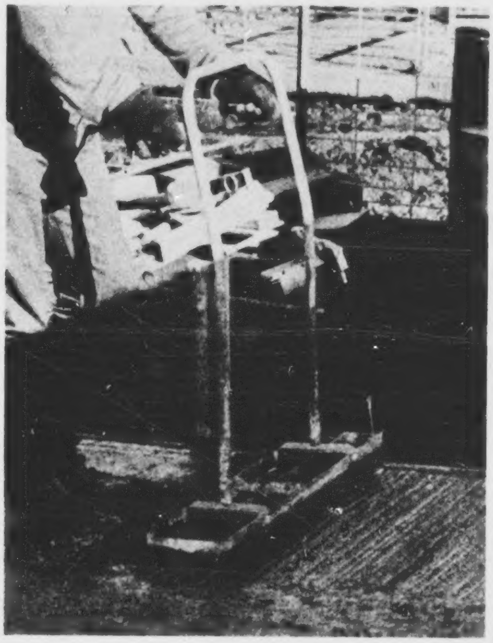
FIGURE 3



JOB SHEET #1

C. Move jitterbug in an up and down motion to compact concrete (Figure 4)

FIGURE 4

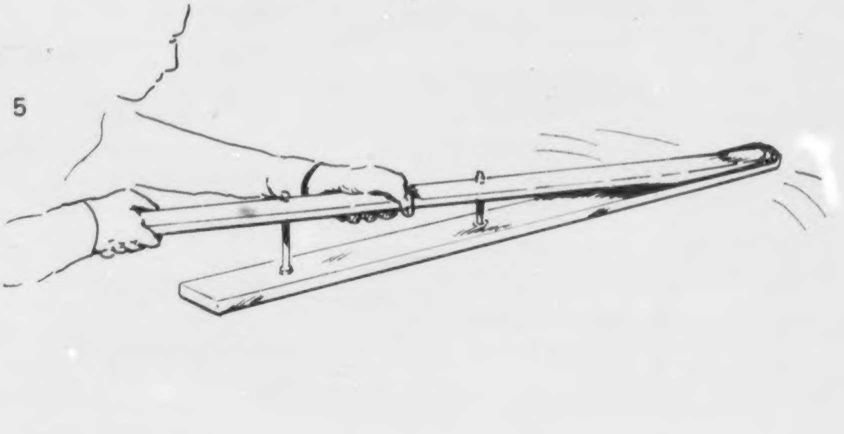


D. Move jitterbug backwards slowly and continue using the up and down motion until slab has been completed

E. Use darby to float surface in a semicircular motion until surface is relatively smooth of high and low places (Figure 5)

(CAUTION: Occasionally, a time period needs to elapse after darbying to allow concrete to harden and the bleed water to leave the concrete.)

FIGURE 5



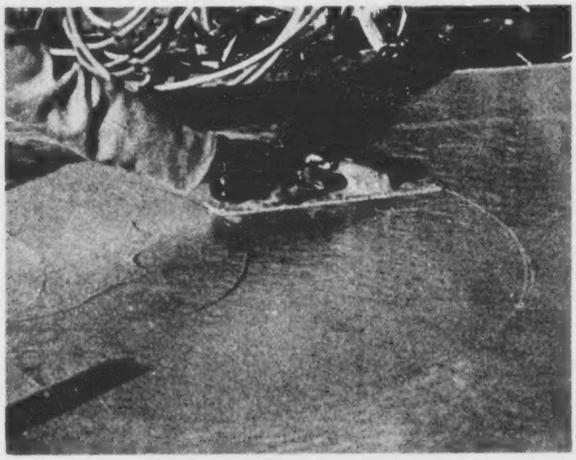
JOB SHEET #1

F. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places (Figure 6)

(NOTE: Keep float relatively flat to surface of concrete.)

(CAUTION: Keep float at right angles to form when working along edge of form.)

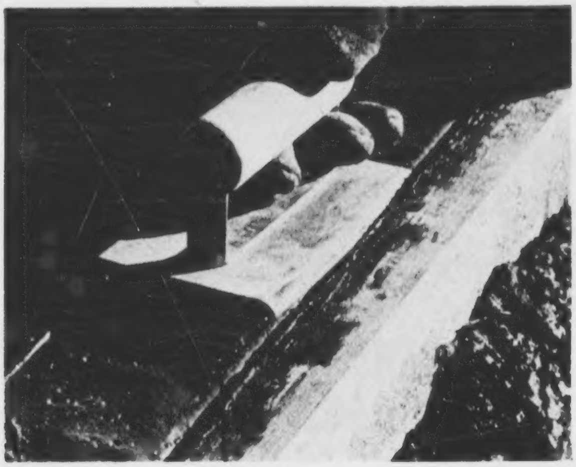
FIGURE 6



G. Tilt up point A of edger and move forward in an arm's length pattern; while still in motion, lift edger at end of pass (Figure 7)

(CAUTION: To avoid pulling surface of concrete up do not remove edger from concrete surface unless edger is in motion.)

FIGURE 7

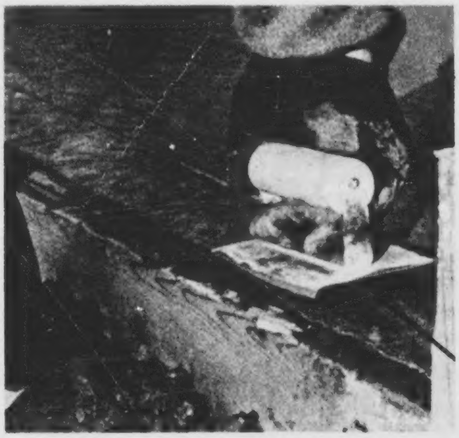


Point A

JOB SHEET #1

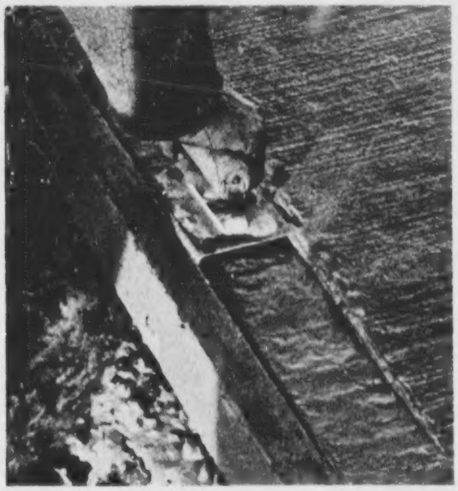
H. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 8)

FIGURE 8



(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 9.)

FIGURE 9



I. Continue this procedure until all edges are rounded and smooth

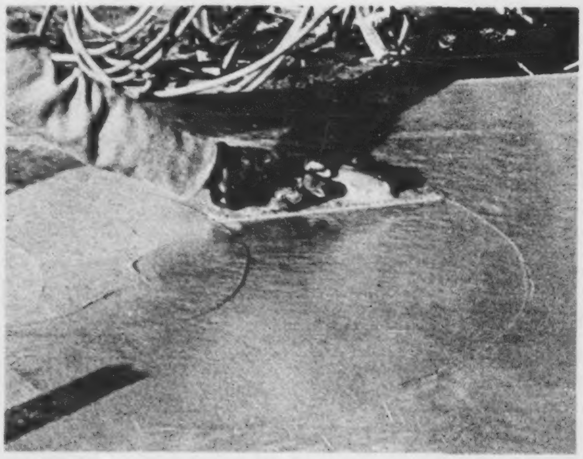
(NOTE: Allow enough time after first floating until desired finish can be obtained.)

J. Start second floating at same point as first floating

JOB SHEET #1

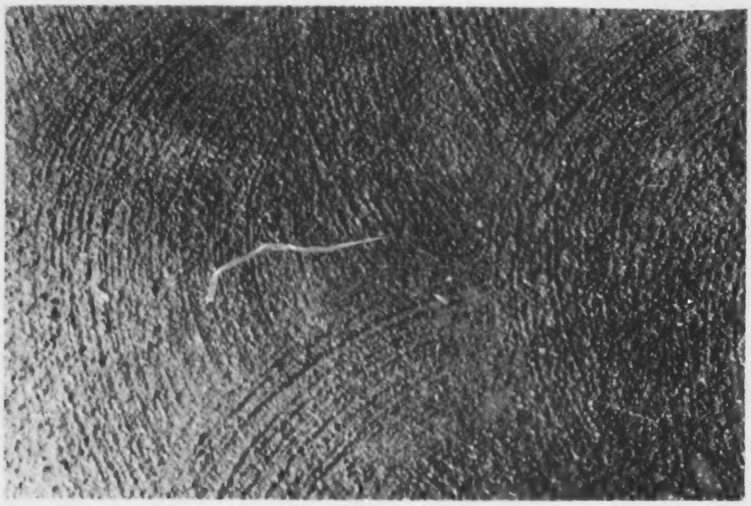
K. Move in a semicircular fanlike motion with float flat to surface of concrete and at arm's length (Figure 10)

FIGURE 10



L. Continue this procedure until slab is complete (Figure 11)

FIGURE 11



M. Apply curing agent using sprayer with nozzle adjusted to a fine mist

N. Use margin trowel to clean top surface of forms and to clean tools and equipment

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #2--FINISH LARGE SLAB WITH FLOAT FINISH

I. Tools and materials

  A. Tools

    1. 12' straightedge
    2. Rollerbug
    3. Bullfloat
    4. Two hand floats and/or one trowel
    5. Edger with 3/8" radius
    6. Knee boards
    7. Margin trowel
    8. Float machine
    9. Sprayer

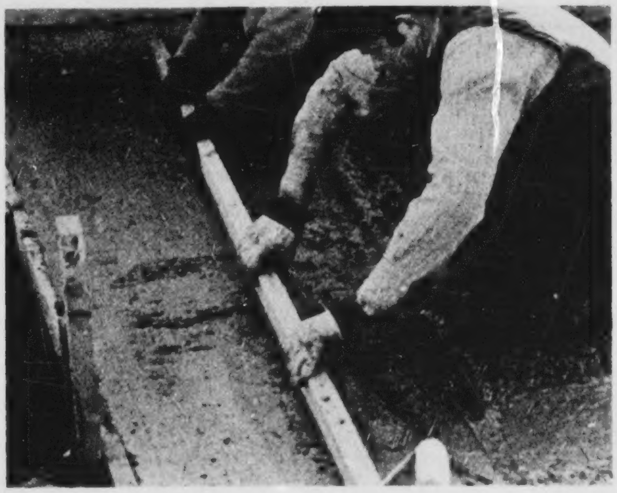
  B. Materials

    1. Concrete
    2. Curing agent

II. Procedure

  A. Place concrete at starting point (Figure 1)

FIGURE 1

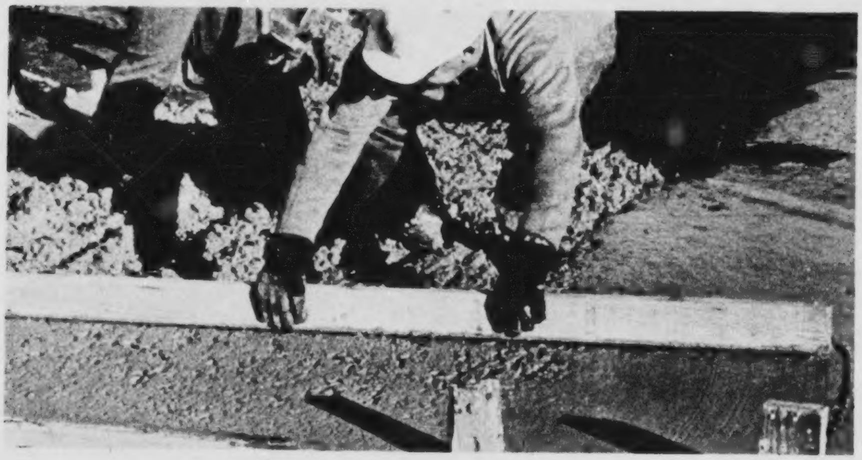


JOB SHEET #2

B. Use straightedge with sawlike motion to rod concrete (Figure 2)

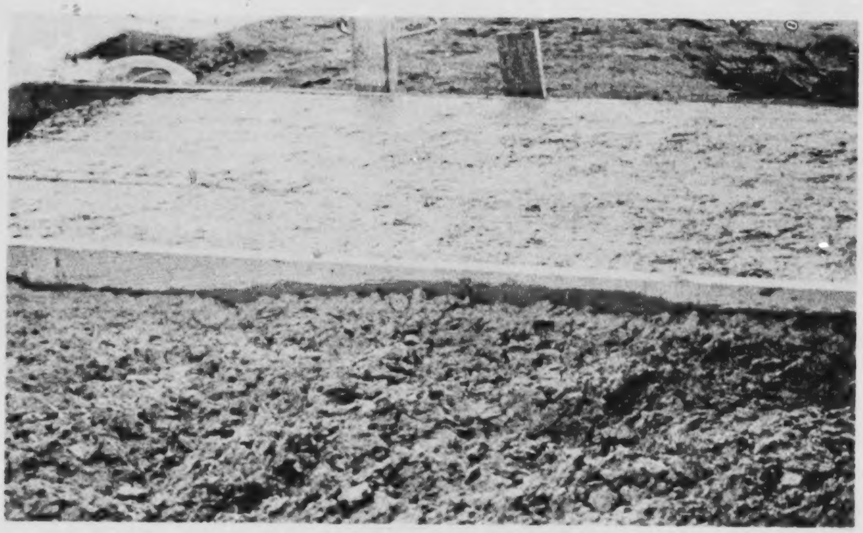
(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind the straightedge to fill holes. See Figure 3.)

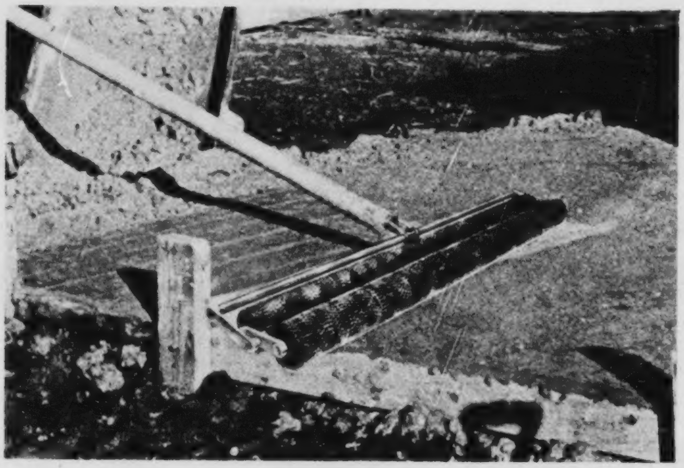
FIGURE 3



JOB SHEET #2

C. Move rollerbug slowly forward and backward across slab, forcing large aggregate beneath the surface and bringing fines to the top (Figure 4)

FIGURE 4

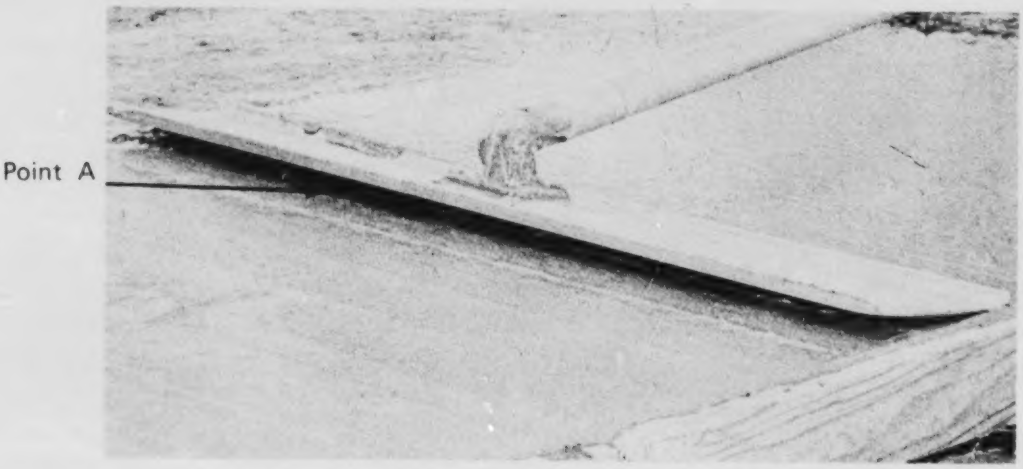


D. Continue rollerbugging until slab has been completed

E. Bullfloat surface with a forward and backward movement immediately after rollerbugging

F. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 5)

FIGURE 5



JOB SHEET #2

G. Position handle of bullfloat so that blade at point B is relatively flat to surface on backward motion (Figure 6)

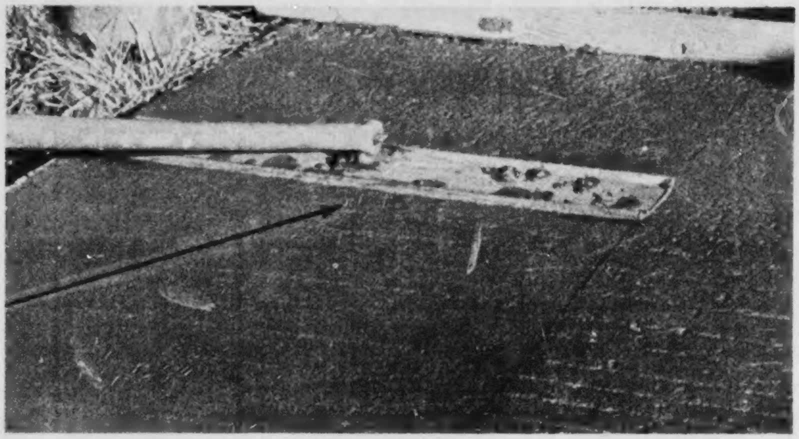


FIGURE 6

Point B

H. Make another pass over first pass, but make the backward motion with the handle positioned so that the blade at point B is slightly raised (Figure 7)

(NOTE: Sometimes it is necessary to bullfloat crosswise to first bullfloating to improve levelness of slab.)

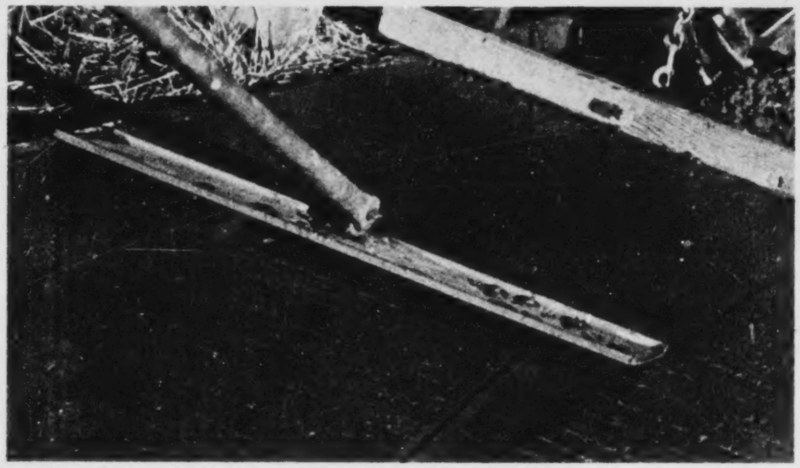


FIGURE 7

Point B

JOB SHEET #2

I. Overlap previous pass slightly and continue process until slab has been floated

(CAUTION: Sometimes a time period needs to elapse after bullfloating to allow concrete to harden and the bleed water to leave the concrete.)

(NOTE: Edges usually set faster; therefore, they should be floated and edged before the rest of the slab.)

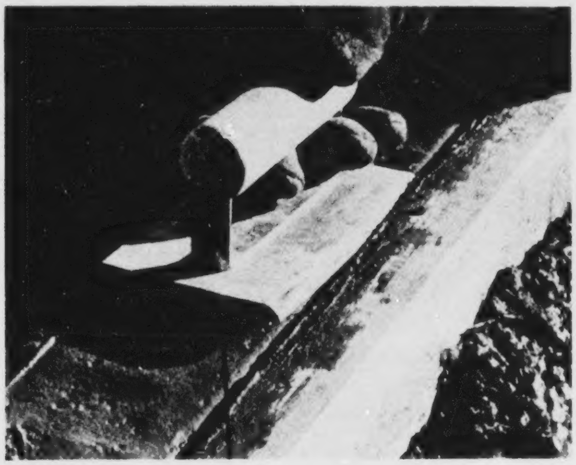
J. Float edges with hand float using a wide semicircular motion until surface is smooth of high and low places

(CAUTION: Keep float at right angles to form when working along edge of form.)

K. Tilt up point A of edger slightly, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid pulling surface of concrete up do not remove edger from concrete surface unless edger is in motion.)

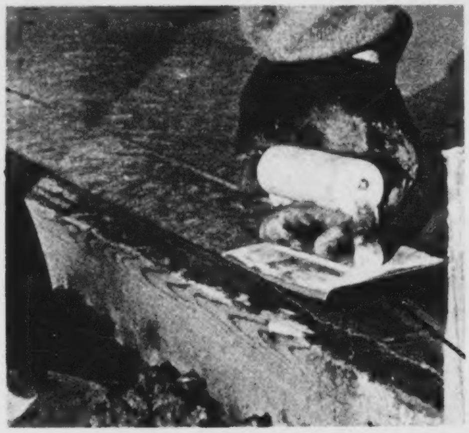
FIGURE 8



JOB SHEET #2

L. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

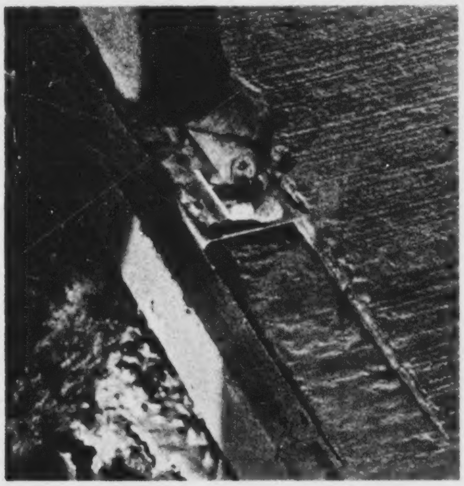
FIGURE 9



M. Continue this procedure until all edges are rounded and smooth

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 10.)

FIGURE 10

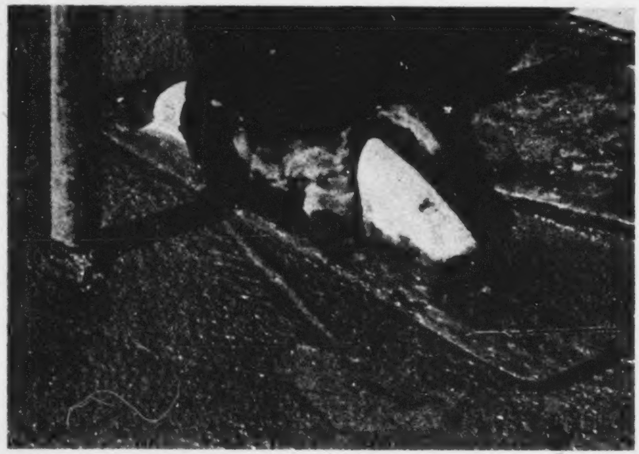


JOB SHEET #2

N. Use hand float to work around pipes, drains, and forms (Figure 11)

(NOTE: Occasionally, a time period needs to elapse to allow the concrete to harden so machine operators' footprints will leave only slight impressions.)

FIGURE 11

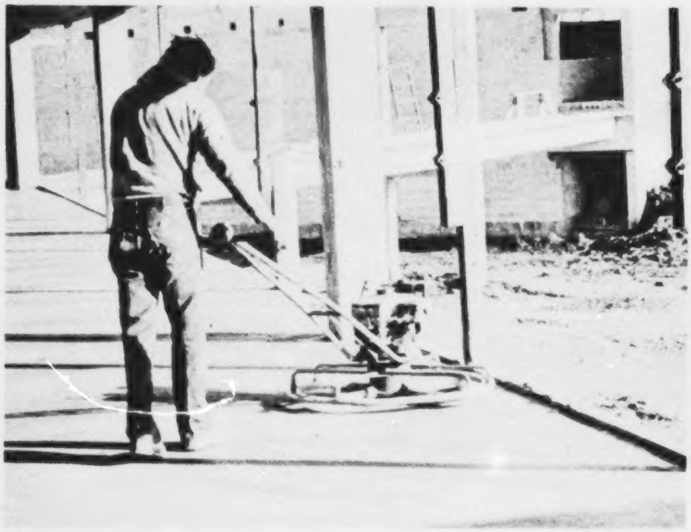


O. Position machine at hardest point of slab

P. Start machine and move it from right to left and back again (Figure 12)

(NOTE: To move machine to the left, raise handle slightly; to move machine to the right, lower handle slightly.)

FIGURE 12



JOB SHEET #2

Q. Make second pass of machine by moving backwards and slightly overlapping first pass (Figure 13)

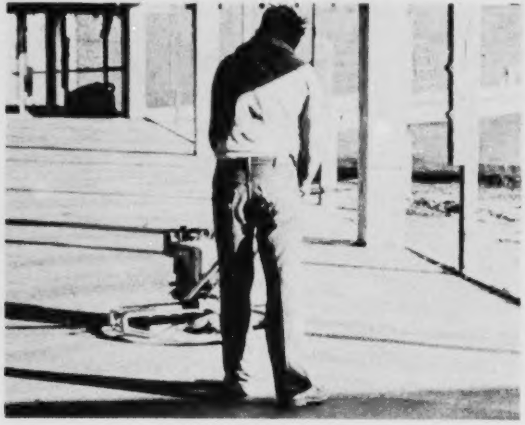


FIGURE 13

R. Continue floating out all footprints and imperfections until slab is completely floated

(NOTE: Allow enough time after machine floating until desired finish can be obtained. Each machining should be done by working at right angles to the previous machining.)

S. Place knee boards at location of hardest area of concrete

T. Position body so that both knees are on knee board A with toes positioned on knee board B (Figure 14)

(NOTE: Balance can be obtained on knee boards by leaning on trowel or float in the left hand and working with right hand.)

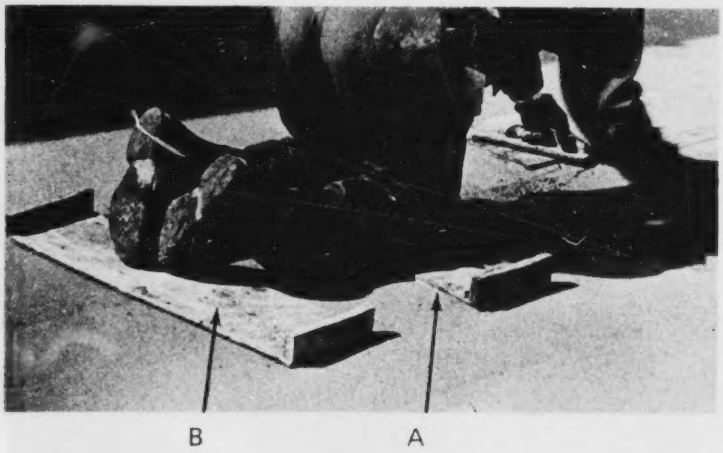


FIGURE 14

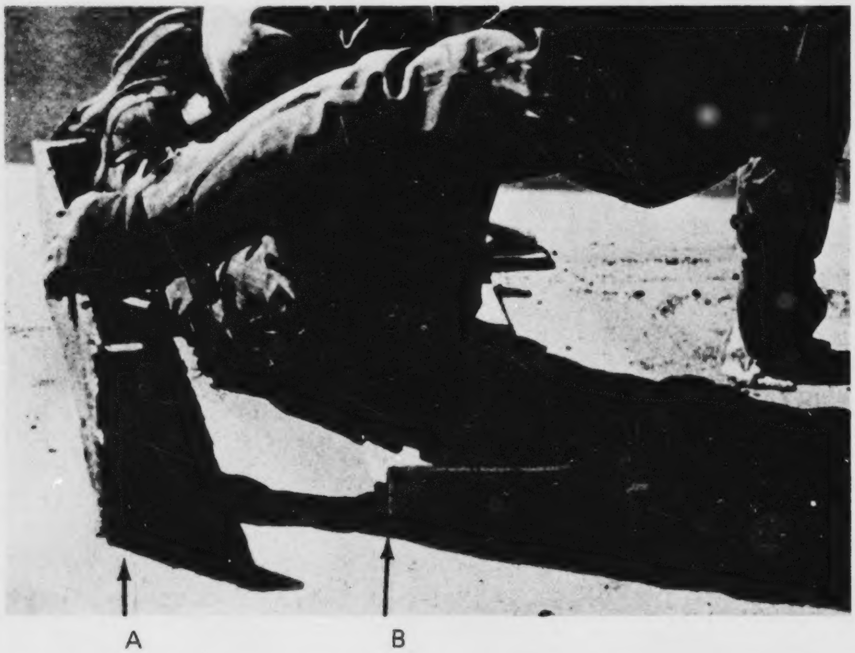
JOB SHEET #2

U. Reach out at arm's length with right hand and float surface with a semicircular fanlike motion, keeping float flat to surface of concrete

V. Move backwards across slab by placing knees on knee board B and by picking up knee board A and placing it behind knee board B (Figure 15)

(CAUTION: To avoid picking up surface of concrete pick knee boards up with a sliding motion.)

FIGURE 15



W. Continue floating and moving backwards over slab until slab is finished

X. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Y. Use margin trowel to clean top surface of forms and to clean tools and equipment

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #3--FINISH SLAB WITH ROUGH BROOM FINISH

I. Tools and materials

A. Tools

1. 10' straightedge
2. Two hand floats and/or one trowel
3. Jitterbug
4. Darby
5. Edger with 1/4" radius
6. Plastic or fiber type push broom
7. Margin trowel
8. Sprayer

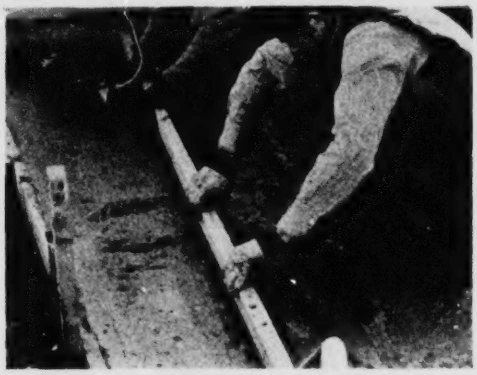
B. Materials

1. Concrete
2. Water (either in container or water hose)
3. Curing agent

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

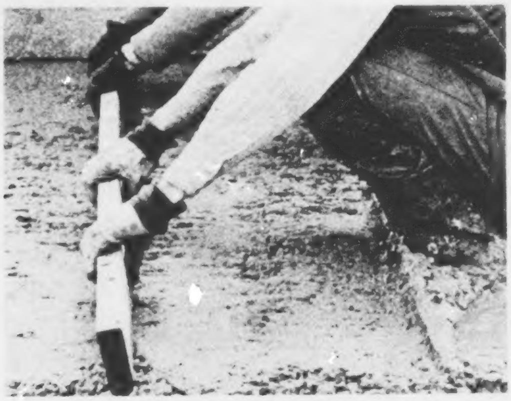


JOB SHEET #3

B. Use straightedge with a sawlike motion to rod concrete (Figure 2)

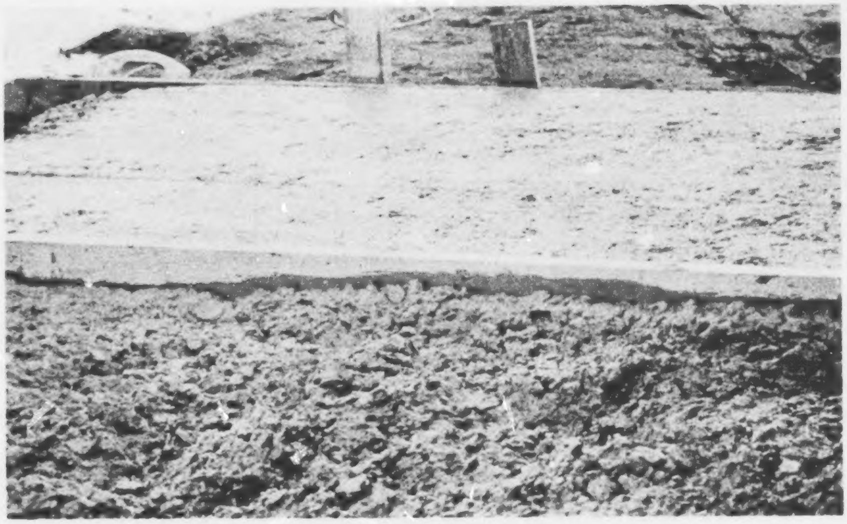
(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be straightedged.)

FIGURE 2



(CAUTION: Care should be taken to keep enough concrete behind straightedge to fill holes. See Figure 3.)

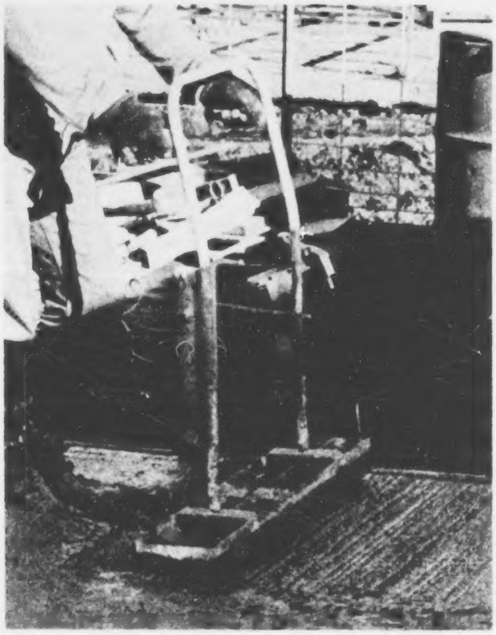
FIGURE 3



JOB SHEET #3

C. Move jitterbug in an up and down motion to compact concrete (Figure 4)

FIGURE 4

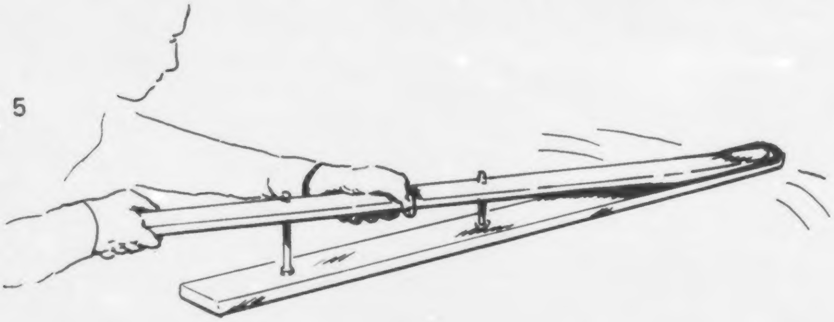


D. Move jitterbug backwards slowly and continue using the up and down motion until slab has been completed

E. Use darby to float surface in a semicircular motion until surface is relatively smooth of high and low places (Figure 5)

(CAUTION: Occasionally, a time period needs to elapse after darbying to allow concrete to harden and the bleed water to leave the concrete.)

FIGURE 5

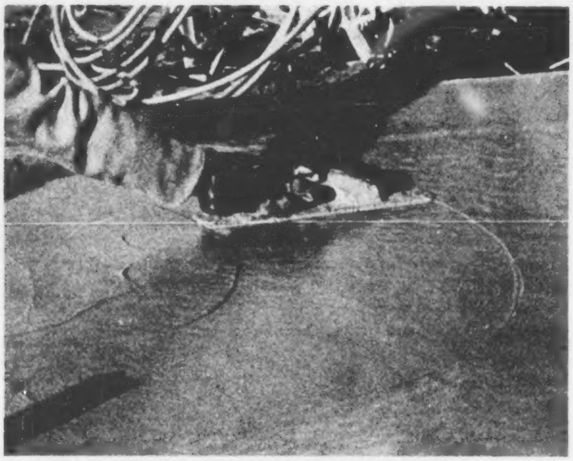


JOB SHEET #3

F. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

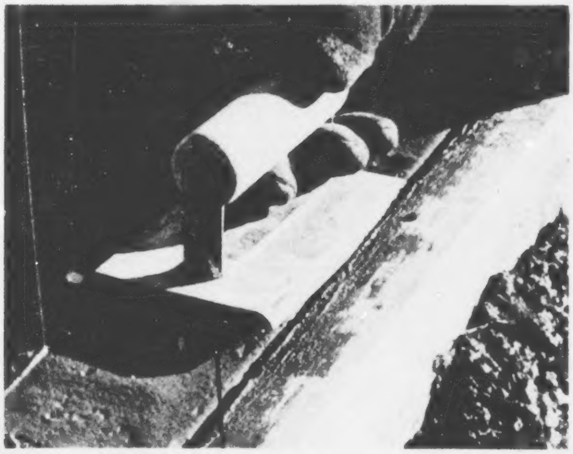
FIGURE 6



G. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 7)

(CAUTION: To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 7



Point A

JOB SHEET #3

H. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 8)

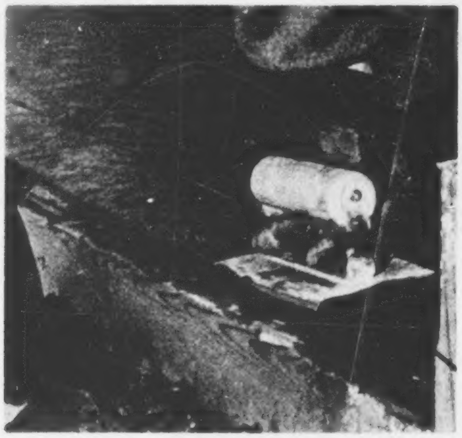


FIGURE 8

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 9.)

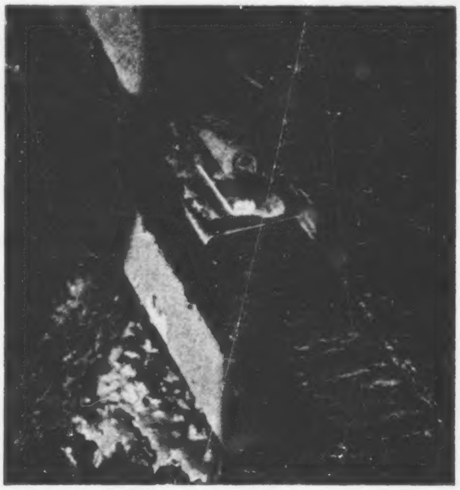


FIGURE 9

I. Continue this procedure until all edges are round and smooth

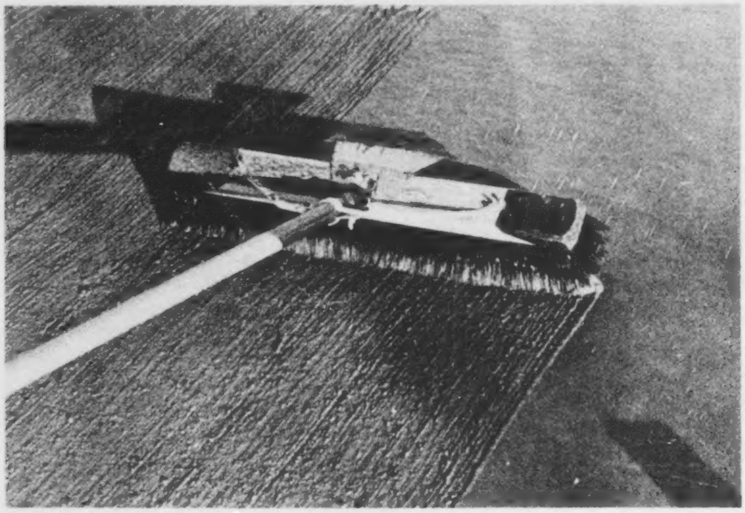
(NOTE: Allow enough time after first floating until desired finish can be obtained.)

JOB SHEET #3

J. Start broom finish by placing broom at one edge and pushing forward across slab (Figure 10)

(NOTE: Broom pattern is usually specified.)

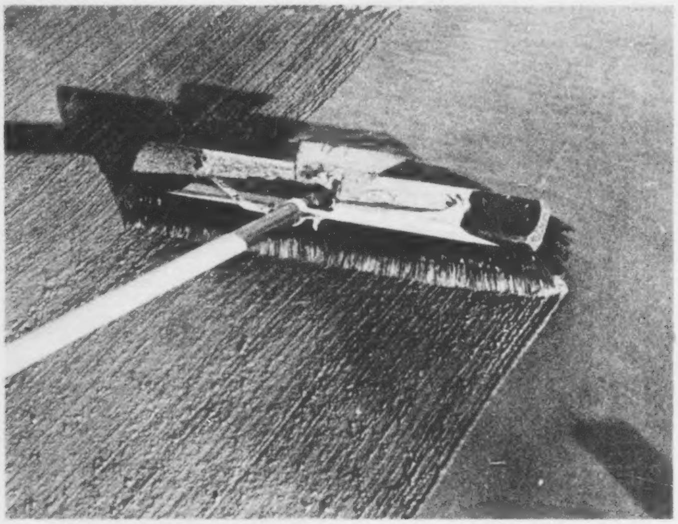
FIGURE 10



K. Lift broom, swing back to starting edge, and again push across slab, slightly lapping first pass (Figures 11 and 12)

FIGURE 11

FIGURE 12



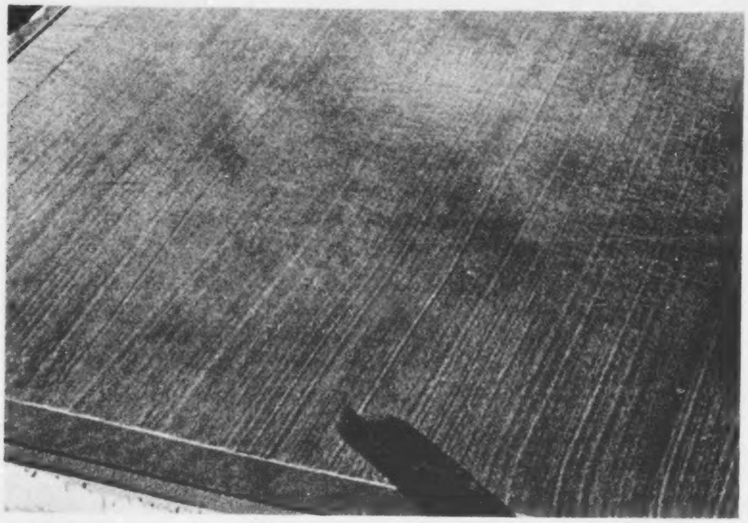
JOB SHEET #3

L. Continue this procedure until slab is completely broomed

M. Edge slab again taking precautions as to tilting edger and picking up edger

(NOTE: This step will complete the slab. See Figure 13.)

FIGURE 13



N. Apply curing agent using sprayer with nozzle adjusted to a fine mist

O. Use margin trowel to clean top surface of forms and to clean tools and equipment

P. Wash out broom thoroughly in clean water

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #4--FINISH SLAB WITH HAND TROWEL

I. Tools and materials

   A. Tools

      1. 10' straightedge
      2. Hand float
      3. Hand trowels

         (NOTE: Various sizes of trowels are used. The size of trowel used depends on the consistency of concrete and personal preference.)

      4. Jitterbug
      5. Darby
      6. Edger with 1/4" radius
      7. Margin trowel
      8. Sprayer

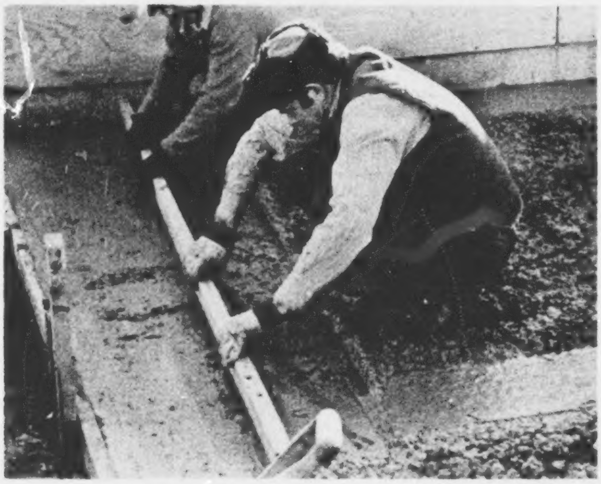
   B. Materials

      1. Concrete
      2. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1

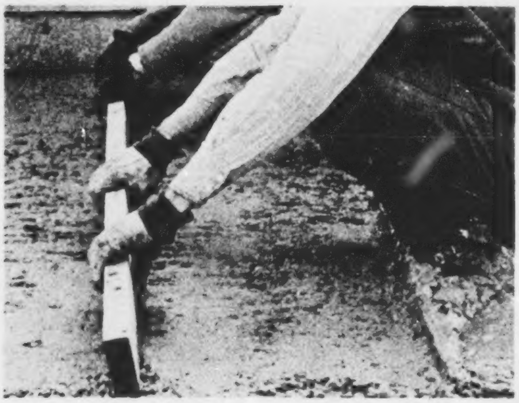


JOB SHEET #4

B. Use straightedge with a sawlike motion to rod concrete (Figure 2)

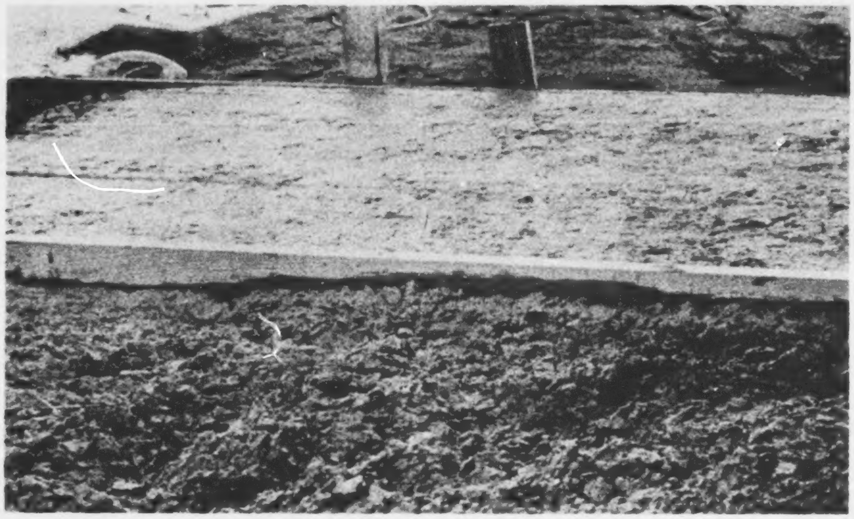
(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be straightedged.)

FIGURE 2



(CAUTION: Care should be taken to keep enough concrete behind straightedge to fill holes. See Figure 3.)

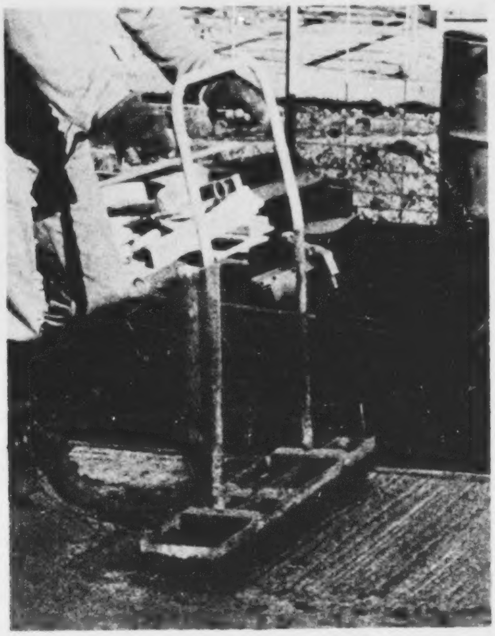
FIGURE 3



JOB SHEET #4

C. Move jitterbug in an up and down motion to compact concrete (Figure 4)

FIGURE 4

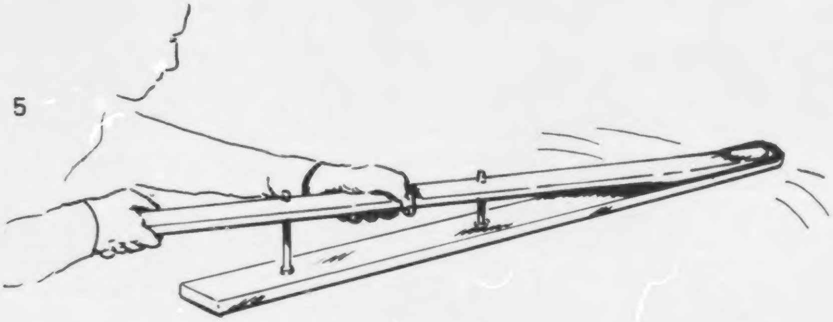


D. Move jitterbug backwards slowly and continue using the up and down motion until slab has been completed

E. Use darby to float surface in a semicircular motion until surface is relatively smooth of high and low places (Figure 5)

(CAUTION: Occasionally, a time period needs to elapse after darbying to allow concrete to harden and the bleed water to leave the concrete.)

FIGURE 5



JOB SHEET #4

F. Float concrete at start of pour with float at arm's length, moving float in wide semicircular motion until surface is smooth of high and low places (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

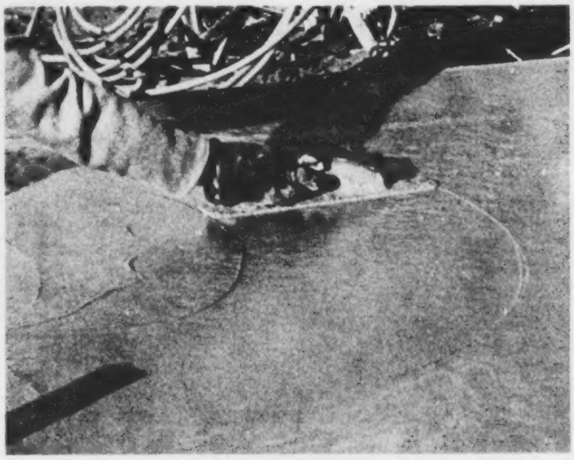


FIGURE 6

G. Trowel surface of concrete with finishing trowel immediately after floating an area

(NOTE: Use same method as mentioned previously.)

H. Tilt trowel slightly and with trowel at arm's length move in semicircular motion until surface is smooth (Figure 7)

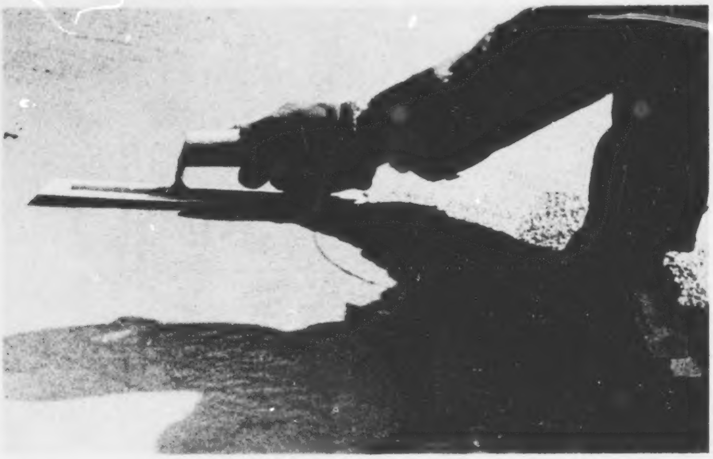


FIGURE 7

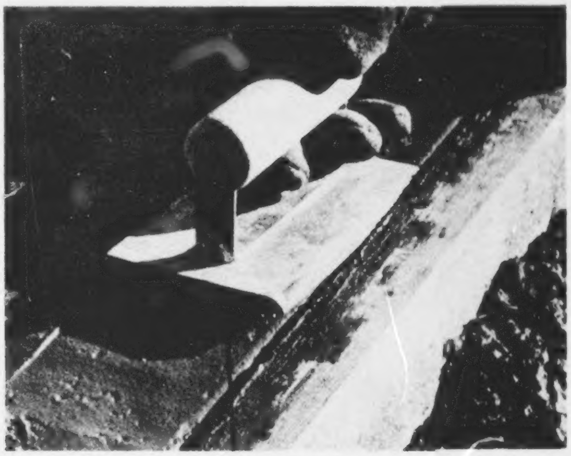
I. Continue troweling until slab has been completed

JOB SHEET #4

J. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid pulling surface of concrete up do not remove edger from concrete surface unless edger is in motion.)

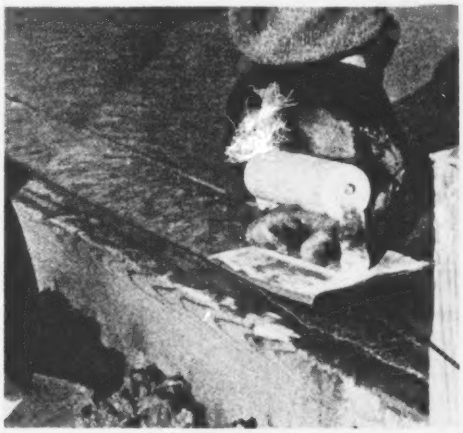
FIGURE 8



Point A

K. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

FIGURE 9

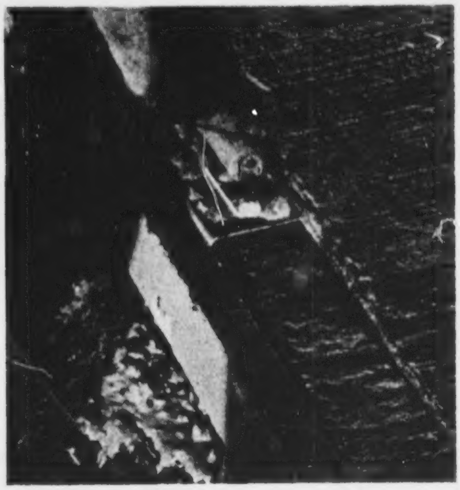


Point B

JOB SHEET #4

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 10.)

FIGURE 10



L. Continue this procedure until all edges are rounded and smooth

(NOTE: Allow enough time after first troweling for surface of concrete to harden sufficiently before second troweling.)

M. Trowel slab second time and re-edge slab using precautions as to tilting and picking up edger

N. Continue this procedure until entire slab is completed

(NOTE: Sometimes it is necessary to trowel slab several times to obtain the desired finish. If this happens, trowel slab as before in a semicircular motion with edge of trowel slightly tilted.)

JOB SHEET #4

O. Continue trowelings until slab is finished (Figure 11)

FIGURE 11

P. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Q. Use margin trowel to clean top surface of forms, tools, and equipment

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #5--FINISH SLAB WITH FINE BROOM FINISH

I. Tools and materials

   A. Tools

      1. 10' straightedge
      2. Hand float
      3. Hand trowels

         (NOTE: Various sizes of trowels are used. Size of trowel used depends on consistency of concrete and personal preference.)

      4. Jitterbug
      5. Darby
      6. Edger with 1/4" radius
      7. Fine-haired push broom
      8. Margin trowel
      9. Sprayer

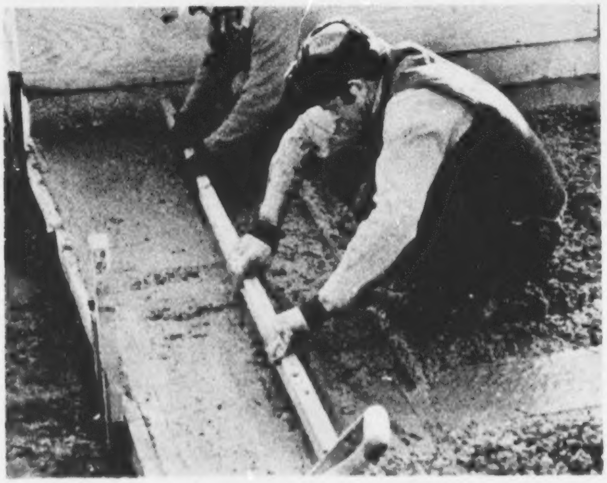
   B. Materials

      1. Concrete
      2. Water (either in container or water hose)
      3. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1

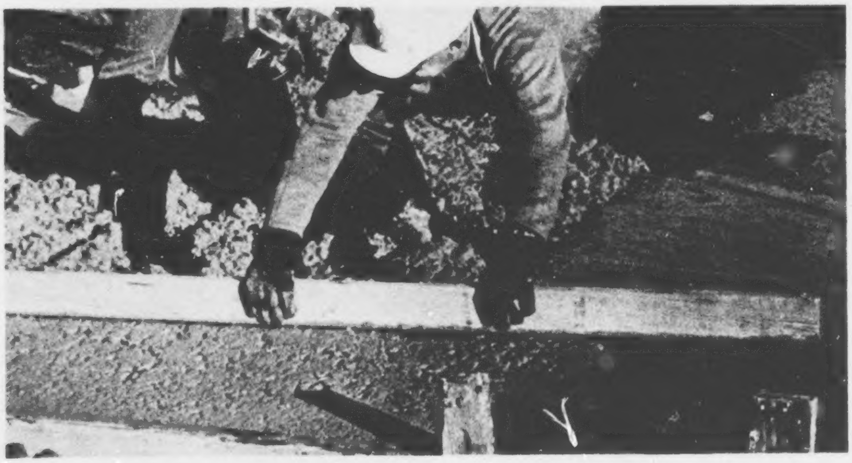


JOB SHEET #5

B. Use straightedge with a sawlike motion and rod concrete (Figure 2)

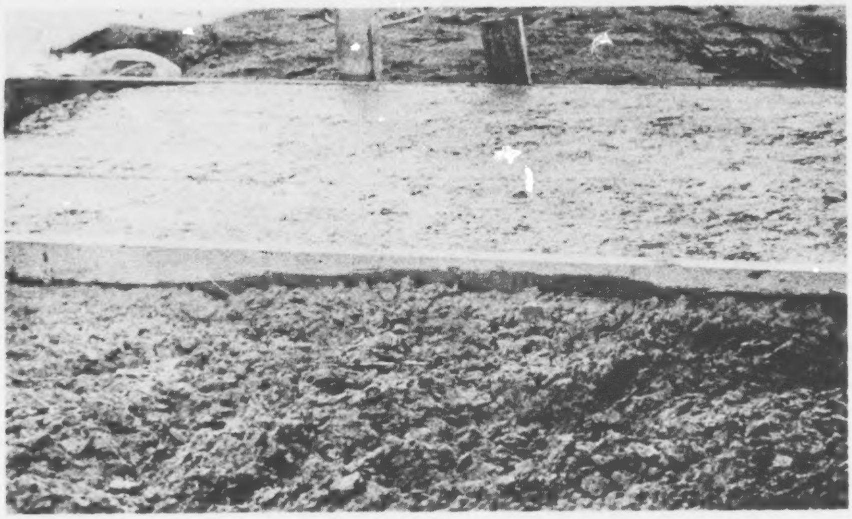
(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind straightedge to fill holes. See Figure 3.)

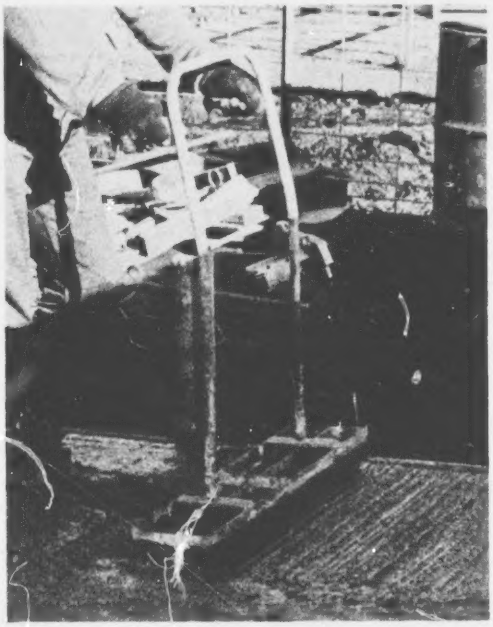
FIGURE 3



JOB SHEET #5

C. Move jitterbug in an up and down motion to compact concrete (Figure 4)

FIGURE 4

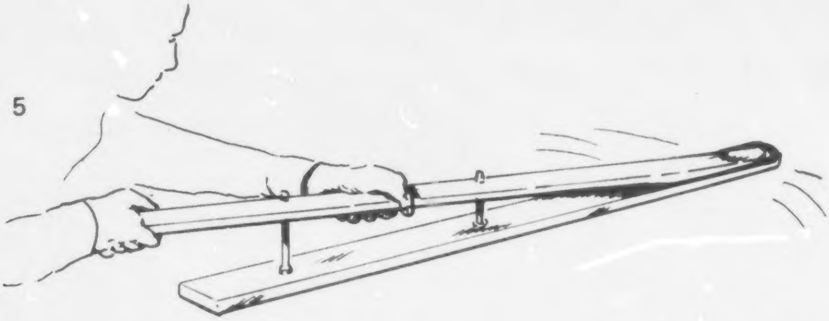


D. Move jitterbug backwards slowly and continue using the up and down motion until slab has been completed

E. Use darby to float surface in a semicircular motion until surface is relatively smooth of high and low places (Figure 5)

(CAUTION: Occasionally, a time period needs to elapse after darbying to allow concrete to harden and the bleed water to leave the concrete.)

FIGURE 5



JOB SHEET #5

F. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

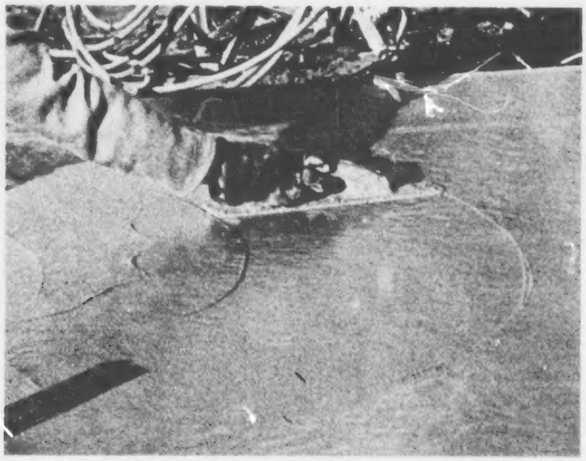


FIGURE 6

G. Trowel surface of concrete with finishing trowel immediately after floating an area

(NOTE: Use the same method as before.)

H. Move trowel in a wide semicircular motion with trowel slightly tilted until surface is smooth (Figure 7)

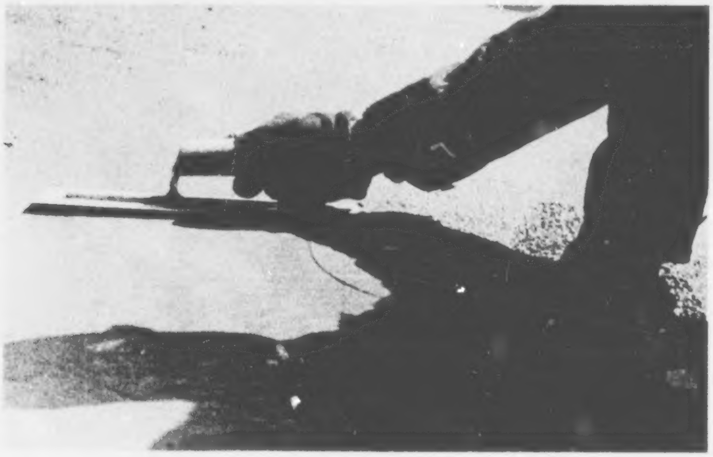


FIGURE 7

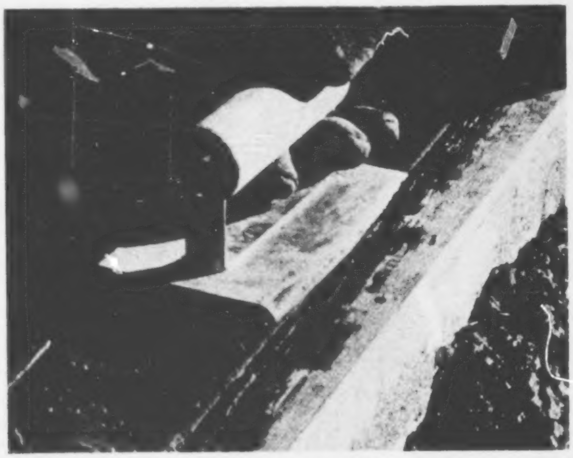
I. Continue troweling until slab has been completed

JOB SHEET #5

J. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid pulling up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 8

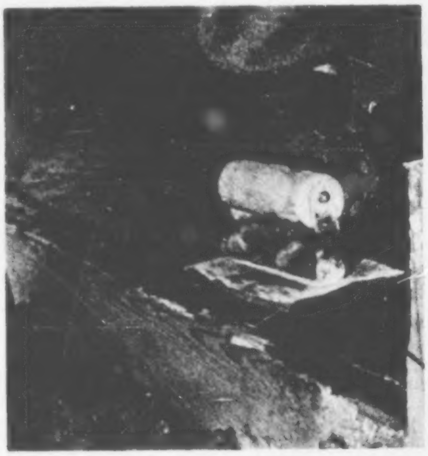


Point A

K. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

(NOTE: Allow enough time after troweling for surface of concrete to harden sufficiently before brooming.)

FIGURE 9

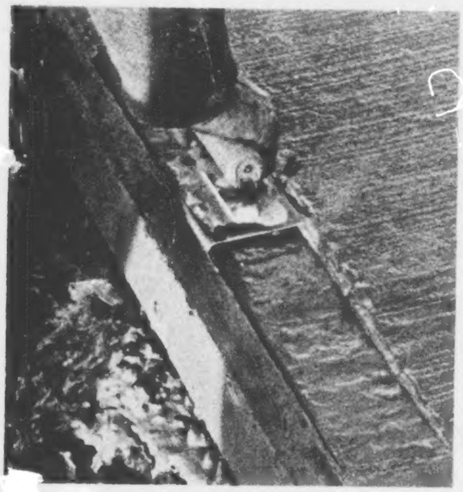


Point B

JOB SHEET #5

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 10.)

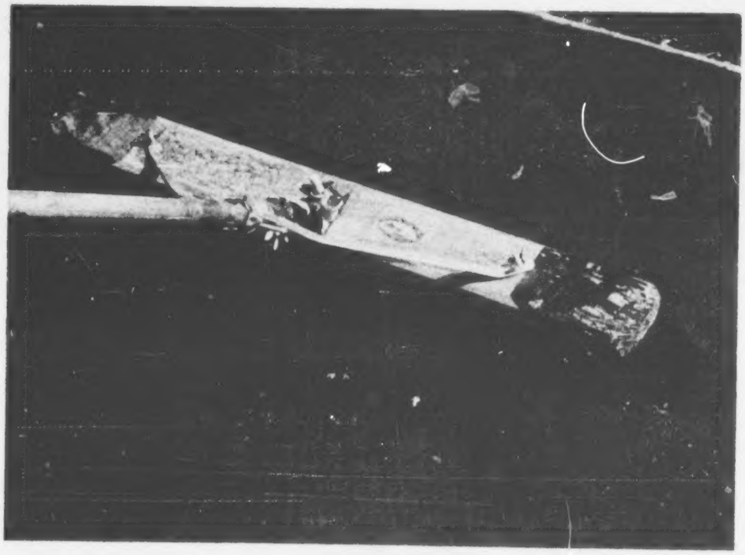
FIGURE 10



L. Continue until all edges are rounded and smooth

M. Start broom finish by placing broom at far edge and pulling across slab (Figure 11)

FIGURE 11



JOB SHEET #5

N. Swing broom back to starting edge and pull across slab, slightly lapping preceding pass (Figures 12 and 13)

FIGURE 12

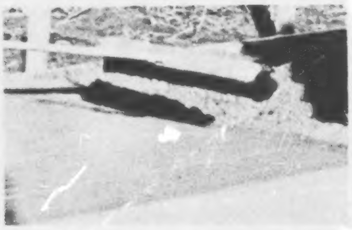
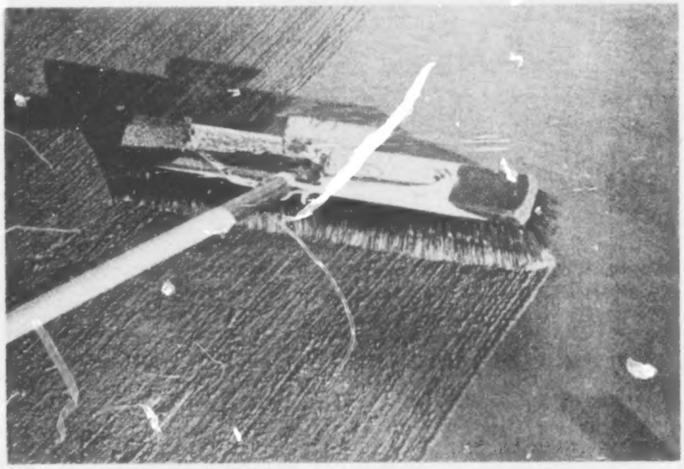


FIGURE 13

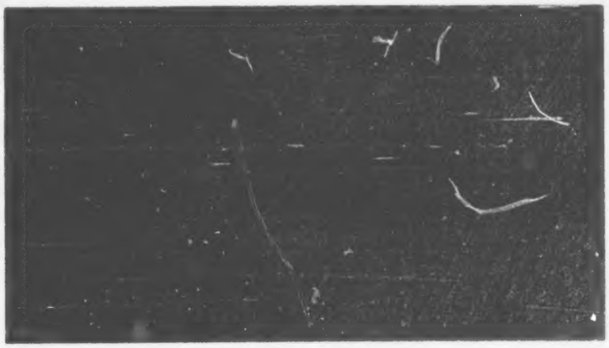


O. Continue this procedure until slab is completely broomed

P. Edge slab again, taking same precautions as to tilting and picking up edger

Q. Continue this procedure until entire slab is completed (Figure 14)

FIGURE 14



R. Apply curing agent using sprayer with nozzle adjusted to a fine mist

S. Use margin trowel to clean top surface of forms, tools, and equipment

T. Wash broom thoroughly in clean water

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #6--FINISH SLAB USING TROWEL MACHINE

I. Tools and materials

A. Tools

1. 12' straightedge
2. Hand float
3. Hand trowels

   (NOTE: Various sizes of trowels are used. Size of trowel used depends on consistency of concrete and personal preference.)

4. Rollerbug
5. Bullfloat
6. Edger with 3/8" radius
7. Trowel machine
8. Margin trowel
9. Sprayer

B. Materials

1. Concrete
2. Curing agent

II. Procedure

A. Place concrete at starting point (Figure 1)

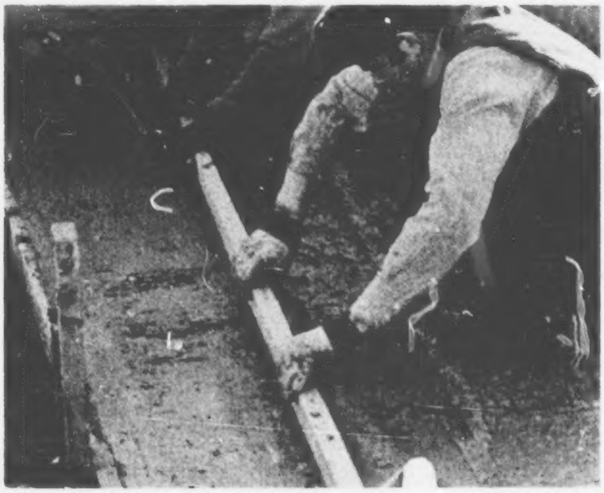


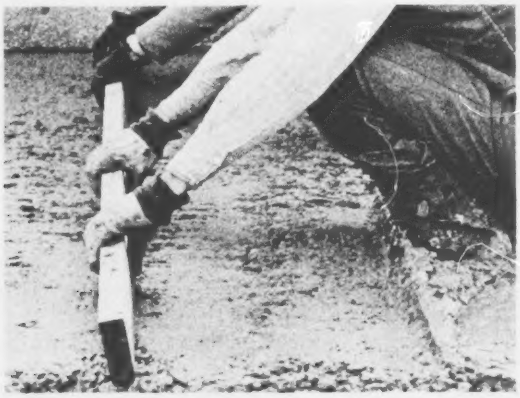
FIGURE 1

JOB SHEET #6

B. Use straightedge with a sawlike motion and rod concrete (Figure 2)

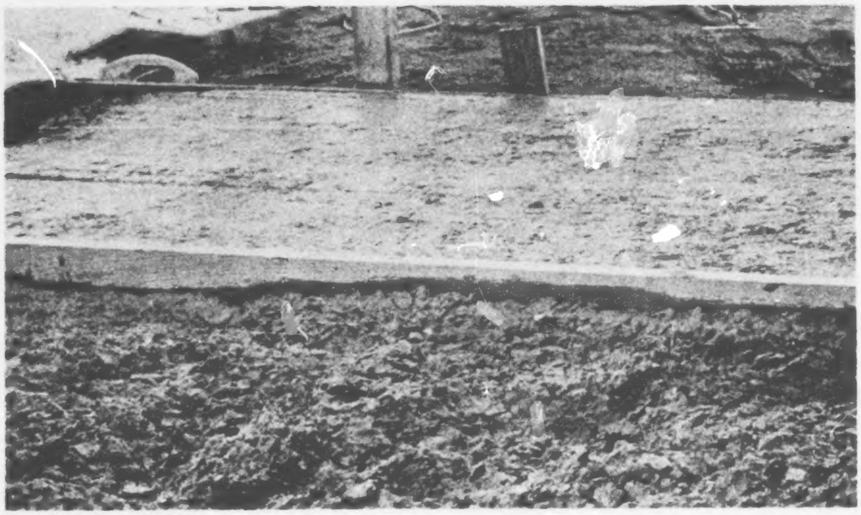
(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind straightedge to fill holes. See Figure 3.)

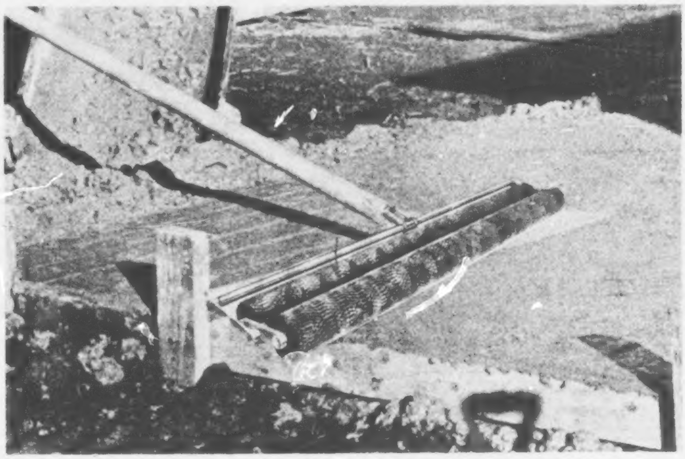
FIGURE 3



JOB SHEET #6

C. Move rollerbug slowly forward and backward across slab, forcing large aggregates beneath the surface and bringing fines to the top (Figure 4)

FIGURE 4

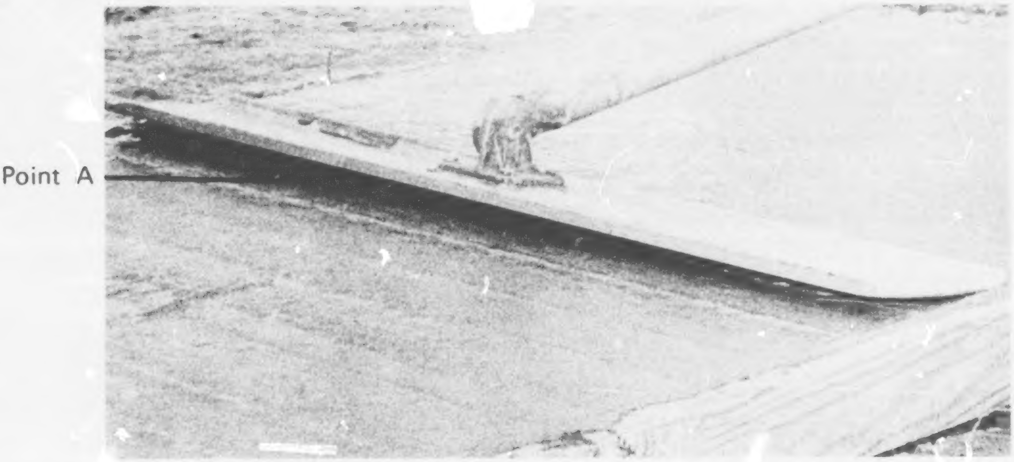


D. Continue rollerbugging until slab has been completed

E. Bullfloat surface with a forward and backward movement immediately after rollerbugging

F. Position handle of the bullfloat so that blade at point A is slightly raised (Figure 5)

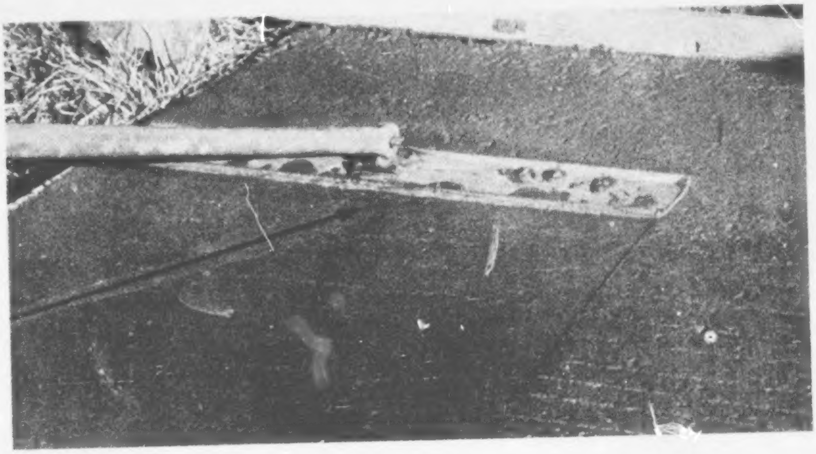
FIGURE 5



JOB SHEET #6

G. Position handle of bullfloat so that edge B is relatively flat to the surface of the concrete (Figure 6)

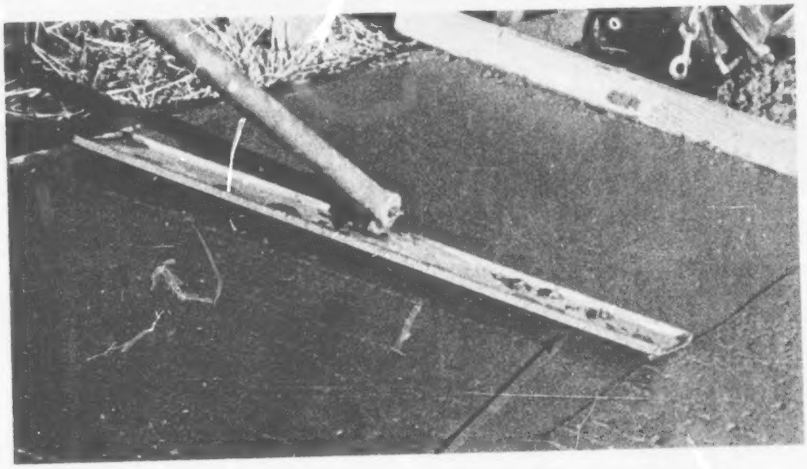
FIGURE 6



Point B

H. Make another pass over first pass making the backward motion with the handle positioned so that the blade at point B is slightly raised (Figure 7)

FIGURE 7



Point B

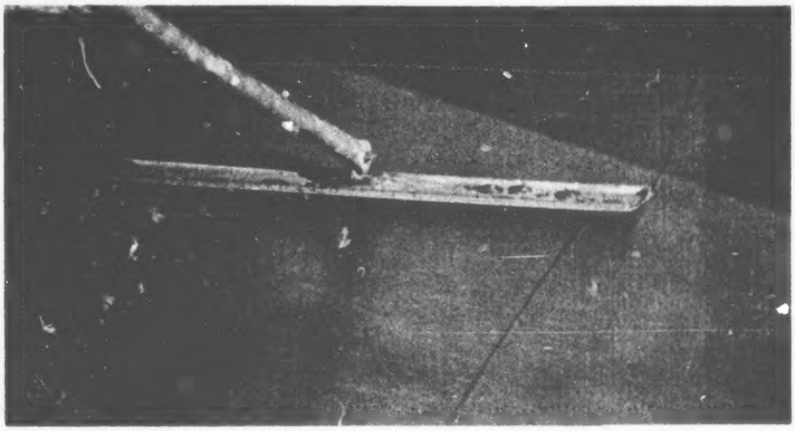
JOB SHEET #6

I. Overlap previous pass slightly and continue process until complete slab has been floated (Figure 8)

(NOTE: Edges usually set faster; therefore, they should be floated and edged before the rest of the slab.)

(CAUTION: Occasionally, a time period needs to elapse after bullfloating to allow concrete to harden and the bleed water to leave the concrete.)

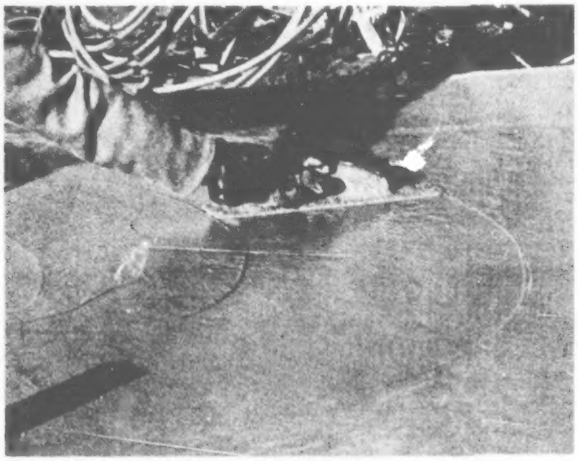
FIGURE 8



J. Float edges with float relatively flat and at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places (Figure 9)

(CAUTION. Keep float at right angles to form when working along edge of form.)

FIGURE 9



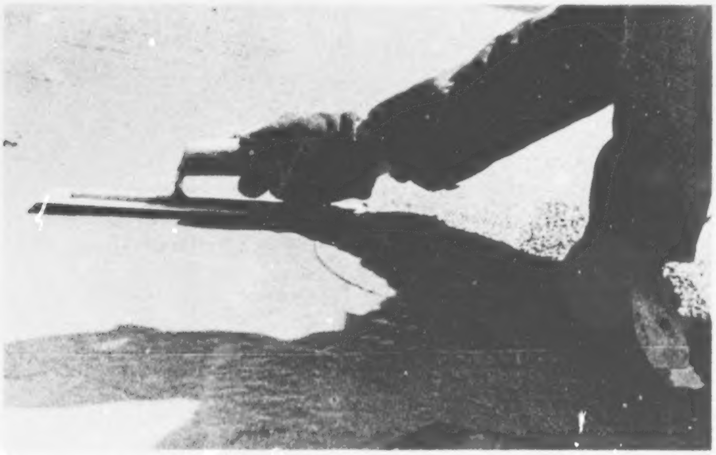
JOB SHEET #6

K. Trowel surface of concrete with finishing trowel immediately after floating an area

(NOTE: Use same method as before.)

L. Tilt trowel slightly and, with trowel at arm's length, move trowel in wide semicircular motion, troweling slab until surface is smooth (Figure 10)

FIGURE 10

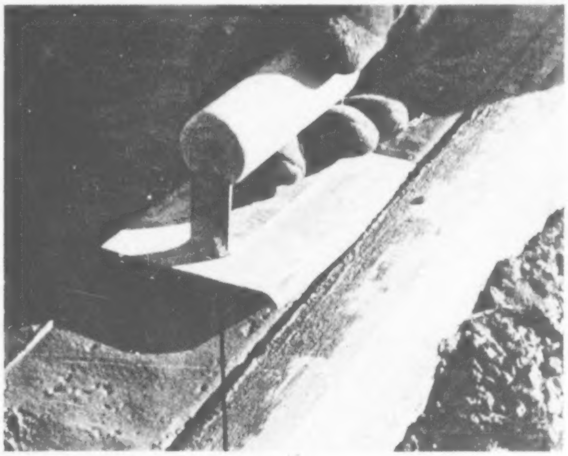


M. Continue troweling until edges have all been troweled

N. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 11)

(CAUTION: To avoid pulling up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 11



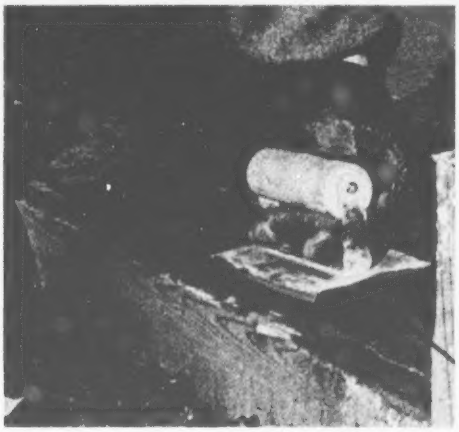
Point A

JOB SHEET #6

O. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 12)

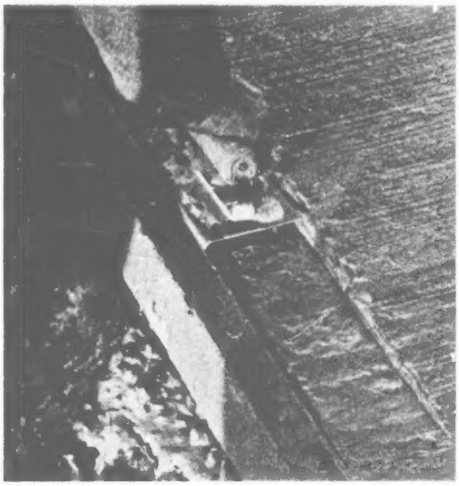
(NOTE: Occasionally a time period needs to elapse to allow the concrete to harden so machine operators' footprints will leave only slight impressions.)

FIGURE 12



(CAUTION: To avoid low places do not place too much pressure on edger while running it. See Figure 13.)

FIGURE 13

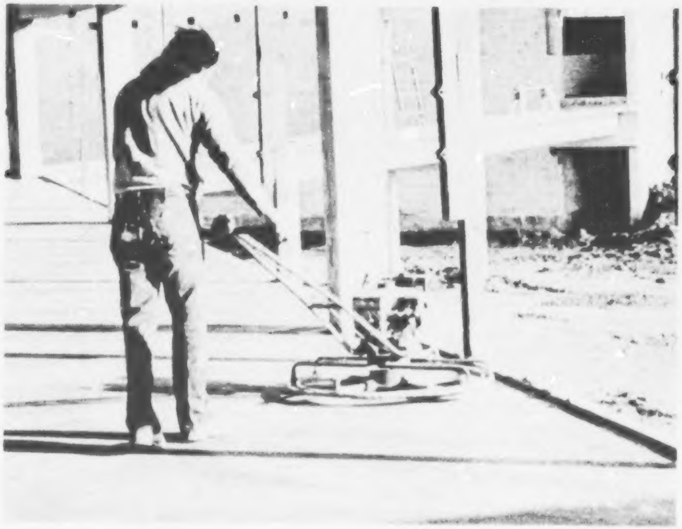


P. Continue until all edges are rounded and smooth

JOB SHEET #6

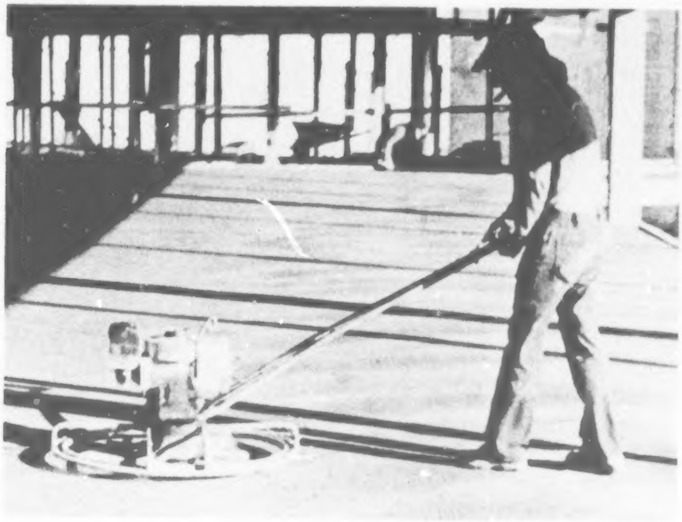
Q. Position trowel machine with float blades and move it from right to left and back again (Figure 14)

FIGURE 14



(NOTE: To move machine to the left, raise handle slightly. To move machine to the right, lower handle slightly. See Figure 15.)

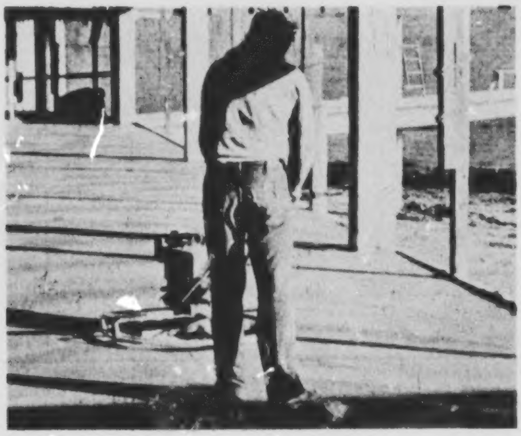
FIGURE 15



JOB SHEET #6

R. Make second pass of machine by moving backwards and slightly overlapping first pass (Figure 16)

FIGURE 16



S. Continue floating out all footprints and imperfections until slab is completely floated

(NOTE: Allow enough time after machine floating before starting finishing process. Concrete must harden enough, again, so that machine operators' footprints will leave only slight impressions.)

T. Use trowel machine with trowel blades to again go over slab

(NOTE: Remember to start at hardest points, move machine from right to left, and move backwards until slab has been finished. Each machining should be done by working at right angles to previous machining.)

U. Retrowel edges and rerun edger using same precautions as to tilting edger and lifting edger

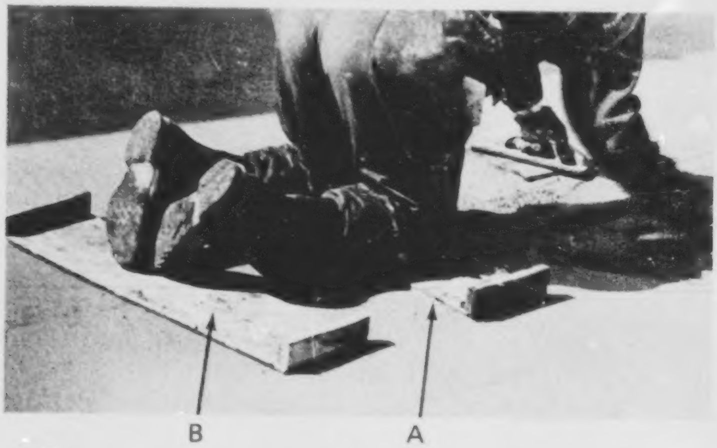
(NOTE: For hard trowel or burnish finish, the troweling process may have to be done several times, depending on how fast the concrete sets. If so, use same method as first time, starting at hardest point and moving from right to left and backwards until slab is finished.)

JOB SHEET #6

V. Place knee boards on concrete and position body so that both knees are on knee board A with toes positioned on knee board B (Figure 17)

(NOTE. Begin this step after last machine troweling, unless otherwise specified.)

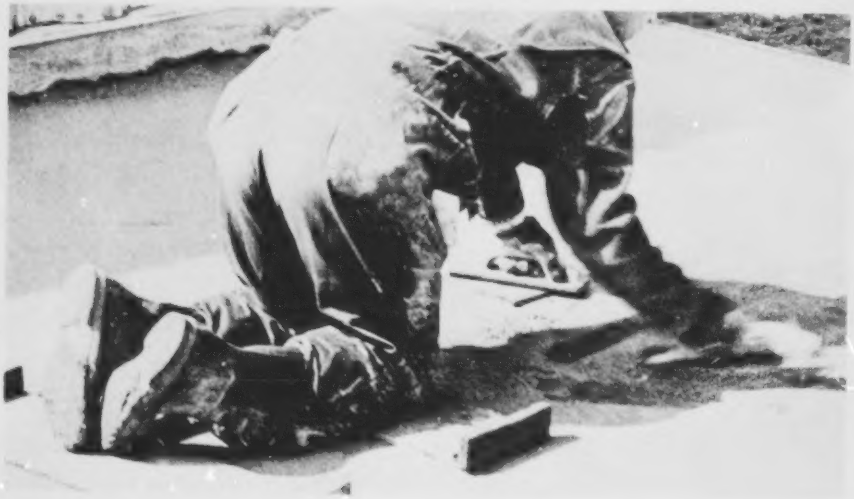
FIGURE 17



W. Obtain balance on knee boards by leaning on a trowel in the left hand and reaching out at arm's length with right hand to trowel surface in a semicircular motion (Figure 18)

(CAUTION. Keep forward edge of trowel slightly tilted up to avoid damage to surface.)

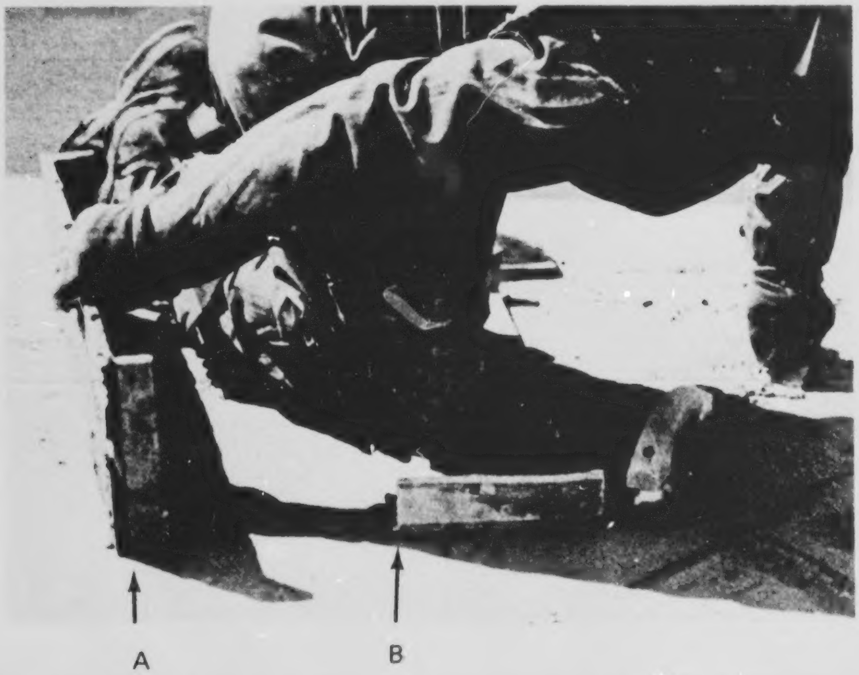
FIGURE 18



JOB SHEET #6

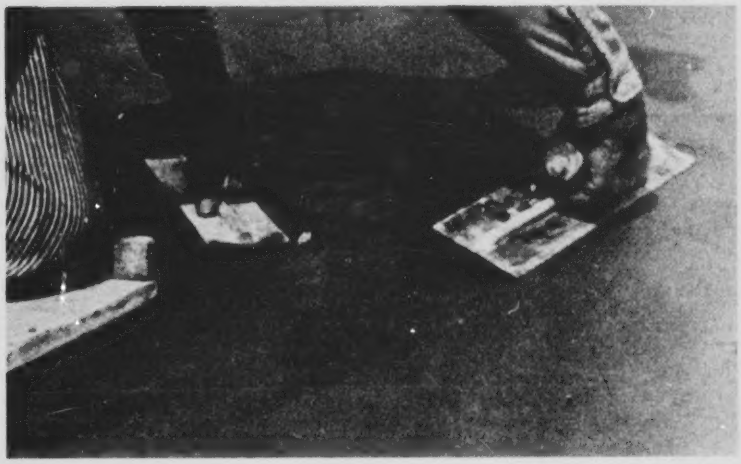
X. Move backwards across slab by placing knees on knee board B and by picking up knee board A and placing it behind knee board B (Figure 19)

FIGURE 19



Y. Continue troweling and moving backwards over slab until slab is finished (Figure 20)

FIGURE 20



JOB SHEET #6

Z. Apply curing agent using sprayer with nozzle adjusted to a fine mist

AA. Use margin trowel to clean top surface of forms and to clean tools and equipment

(NOTE: If a burnished finish is specified, the hand finish should be done with trowel fairly flat, leaving surface of concrete with a fine fuzzy finish. Last troweling can be done either by hand or by machine. This process will begin when concrete is hard enough so that there will be a ringing sound as the trowel passes over the surface.)

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #7-FINISH SLAB WITH SWIRL FINISH: SWEAT TROWEL

I. Tools and materials

   A. Tools

      1. 12' straightedge
      2. Hand float
      3. Hand trowels

         (NOTE: Various sizes of trowels are used. The size of trowel depends on consistency of concrete and personal preference.)

      4. Rollerbug
      5. Bullfloat
      6. Edger with 3/8" radius
      7. Trowel machine
      8. Margin trowel
      9. Sprayer

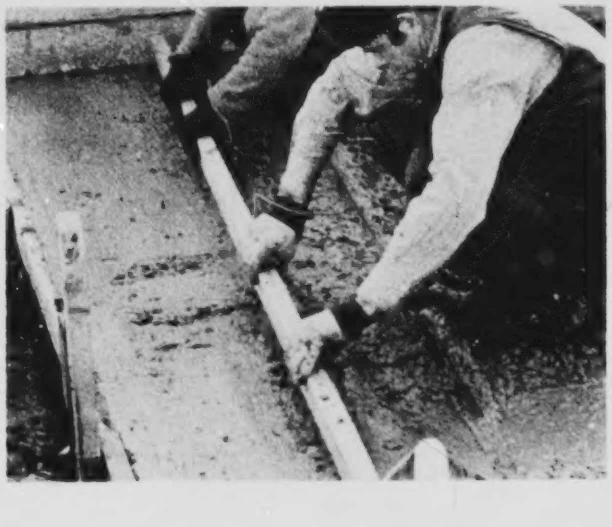
   B. Materials

      1. Concrete
      2. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1

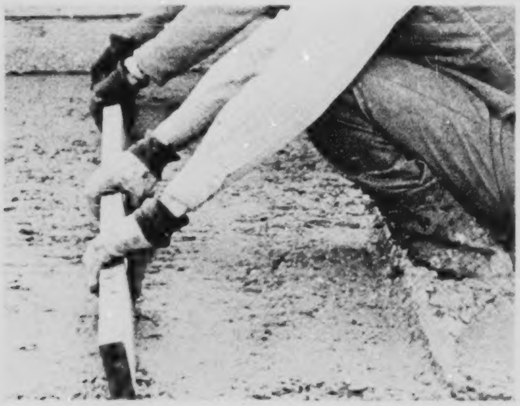


JOB SHEET #7

B. Use straightedge with sawlike motion and rod concrete (Figure 2)

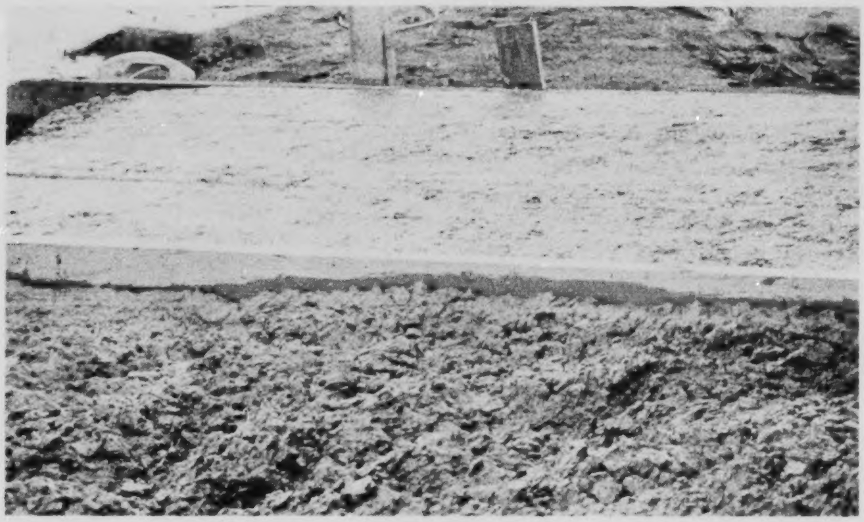
(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

FIGURE 2



(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes. See Figure 3.)

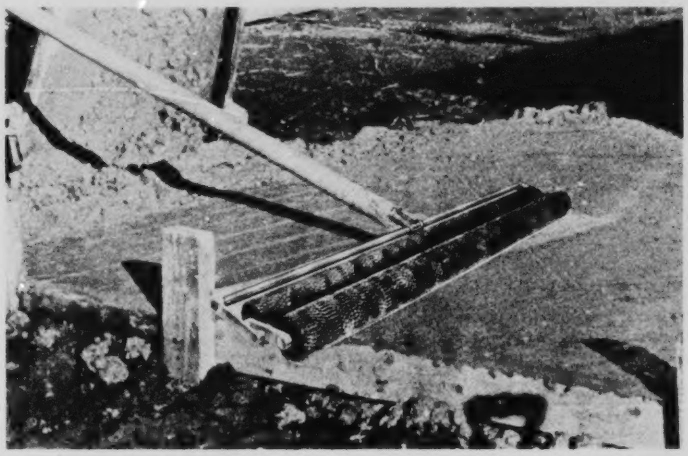
FIGURE 3



JOB SHEET #7

C. Move rollerbug slowly forward and backward across slab, forcing large aggregates beneath the surface and bringing fines to the top (Figure 4)

FIGURE 4

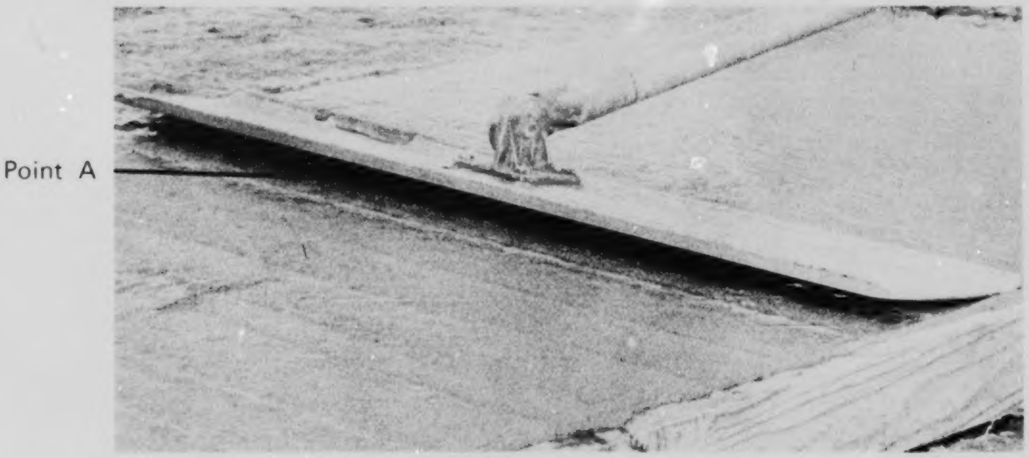


D. Continue rollerbugging until the slab has been completed

E. Bullfloat surface with a forward and backward movement immediately after rollerbugging

F. Position handle of bullfloat so that blade at point A is slightly raised on forward motion (Figure 5)

FIGURE 5



JOB SHEET #7

G. Position handle of bullfloat so that blade at point B is relatively flat to surface on backward motion (Figure 6)

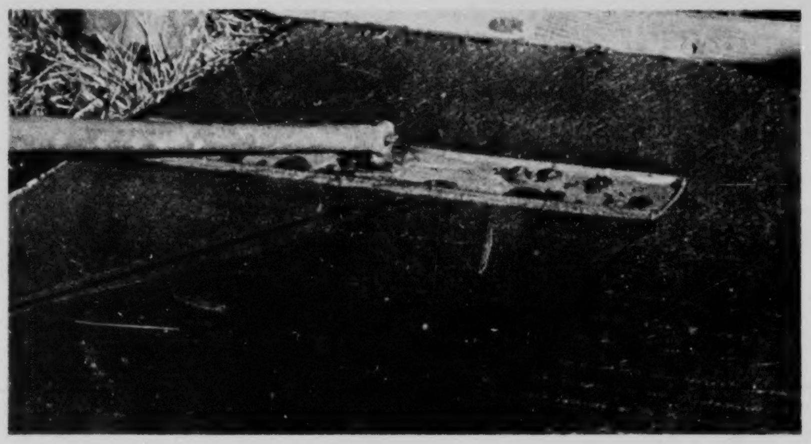


FIGURE 6

Point B

H. Make another pass over first pass, but make the backward motion with the handle positioned so that the blade at point B is slightly raised (Figure 7)

(NOTE: Sometimes it is necessary to bullfloat crosswise to first bullfloating to improve levelness of slab.)

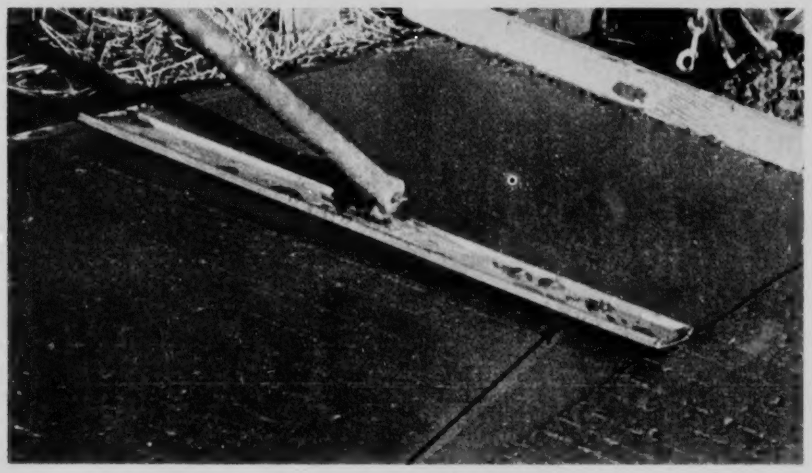


FIGURE 7

Point B

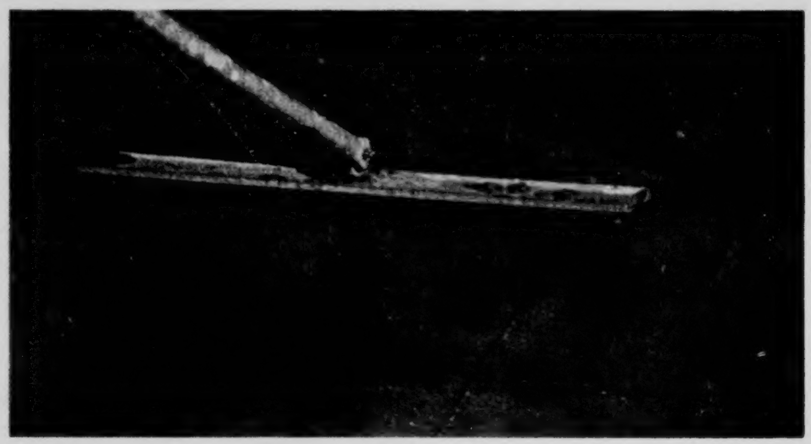
JOB SHEET #7

I. Overlap previous pass slightly and continue process until complete slab has been floated (Figure 8)

(NOTE: Edges usually set faster; therefore, they should be floated and edged before the rest of the slab.)

(CAUTION: Occasionally, a time period needs to elapse after bullfloating to allow concrete to harden and the bleed water to leave the concrete.)

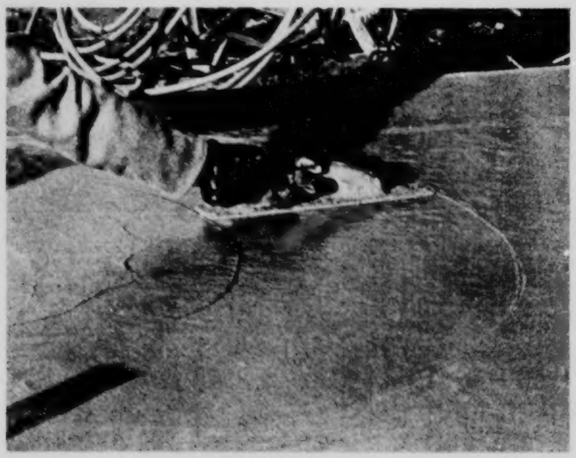
FIGURE 8



J. Float edges with float relatively flat and at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places (Figure 9)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 9



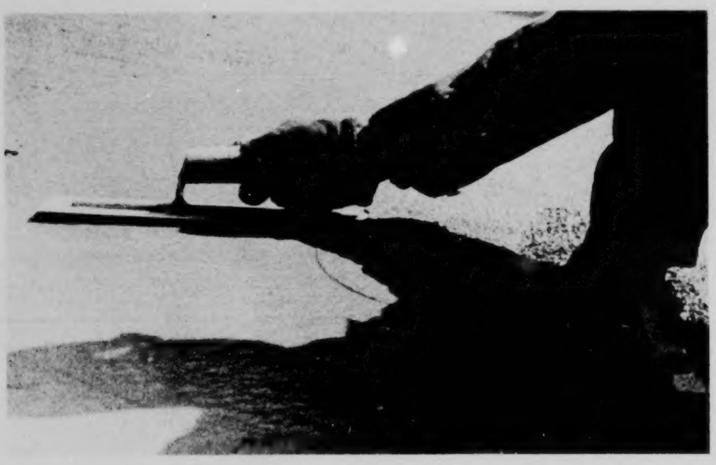
JOB SHEET #7

K. Trowel surface of concrete with finishing trowel immediately after floating an area

(NOTE: Use same method as when floating.)

L. Tilt trowel slightly and, with trowel at arm's length, move trowel in semicircular motion until slab is smooth (Figure 10)

FIGURE 10

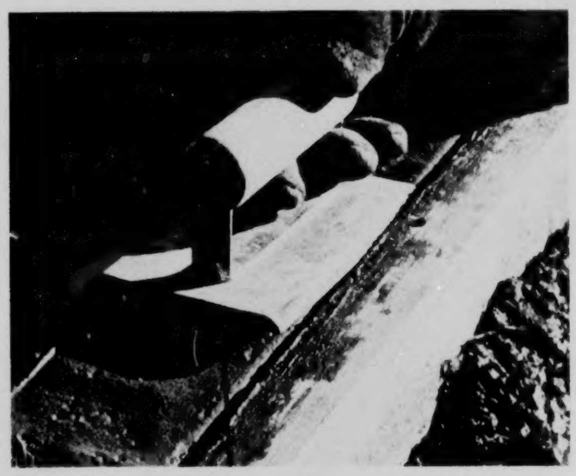


M. Continue troweling until all edges have been completely troweled

N. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 11)

(CAUTION: To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 11



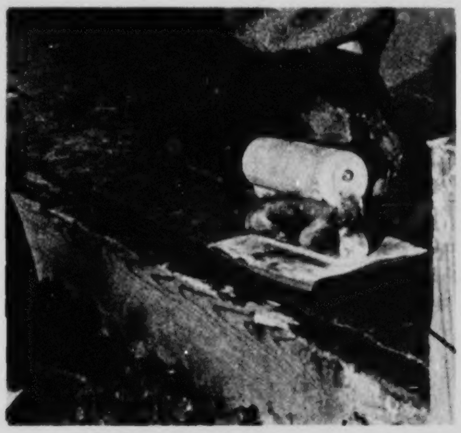
Point A

JOB SHEET #7

O. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 12)

(NOTE: Occasionally, a time period needs to elapse to allow concrete to harden enough so machine operators' footprints will leave only slight impressions.)

FIGURE 12



(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 13.)

FIGURE 13

P. Continue until all edges are rounded and smooth

JOB SHEET #7

Q. Position trowel machine with float blades at hardest point of concrete slab

R. Start machine and move it from right to left and back again (Figure 14)

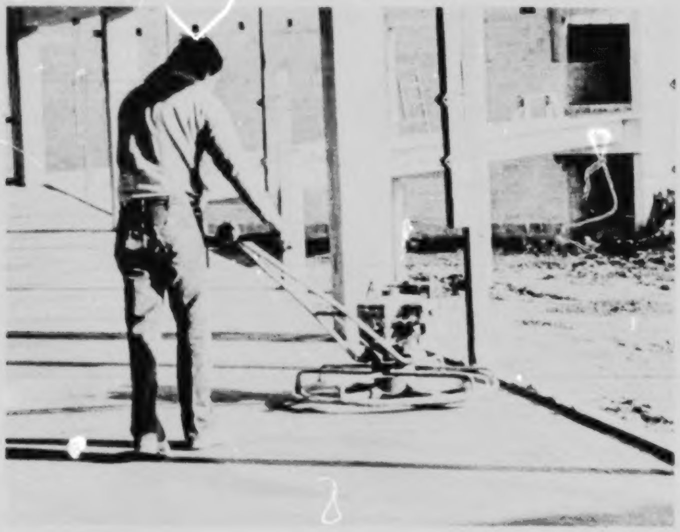


FIGURE 14

(NOTE: To move machine to the left, raise handle slightly. To move machine to the right, lower handle slightly. See Figure 15.)

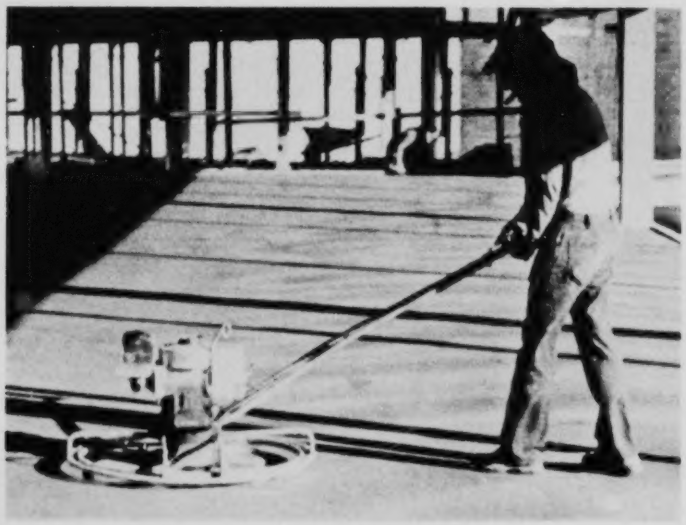
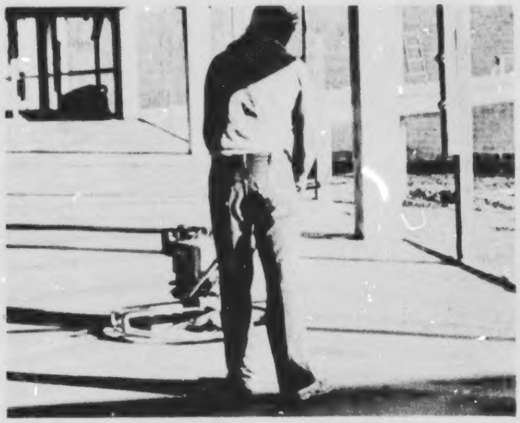


FIGURE 15

JOB SHEET #7

S. Make second pass of machine by moving backwards and slightly overlapping first pass (Figure 16)

FIGURE 16



T. Continue floating out all footprints and imperfections until slab is completely floated

(NOTE: Allow enough time after machine floating before starting finishing process. Again, concrete must harden enough so that machine operators' footprints will leave only slight impressions. Each machining should be done by working at right angles to previous machining.)

U. Use trowel machine with trowel blades to again go over slab

(NOTE: Remember to start at hardest point, move machine from right to left, and move backwards until slab is completely finished.)

V. Retrowel edges and rerun edger using same precautions as to tilting edger and picking up edger

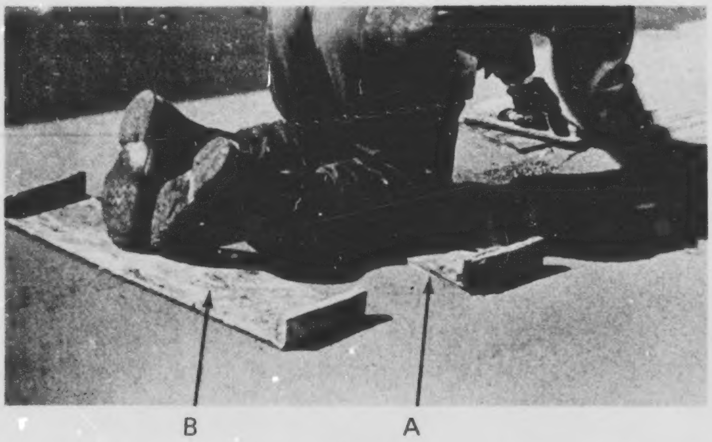
(NOTE: Allow enough time after this troweling until desired finish can be obtained.)

W. Place knee boards at location of hardest area of concrete

X. Position body so that both knees are on knee board A with toes positioned on knee board B (Figure 17)

JOB SHEET #7

FIGURE 17



Y. Obtain balance on knee board by leaning on a trowel in left hand and reaching out at arm's length with right hand

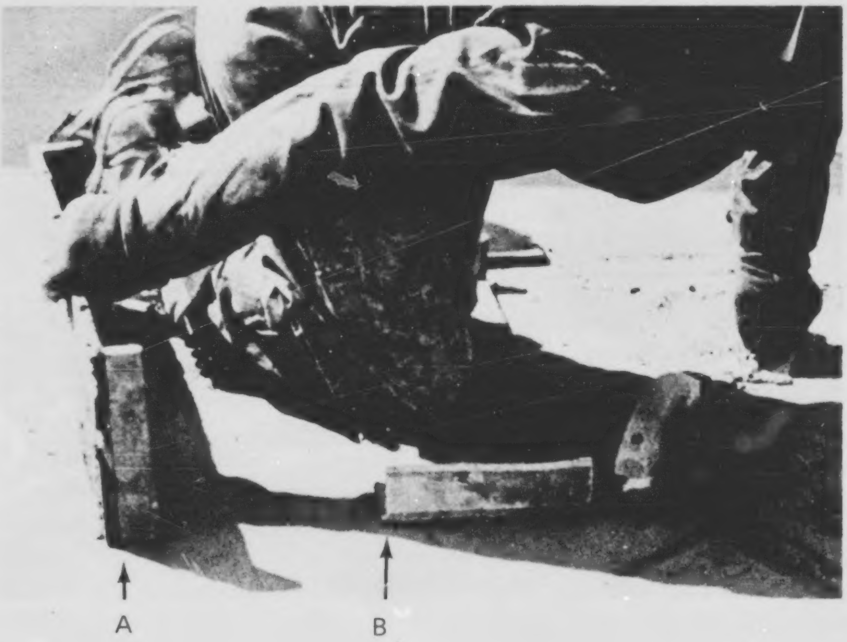
Z. Trowel surface with a semicircular fanlike motion, keeping trowel flat to surface of concrete

(NOTE: This will leave a fuzzy fanlike pattern or a swirl finish.)

AA. Move backwards across slab by placing knees on knee board B, picking up knee board A, and placing it behind knee board B (Figure 18)

(CAUTION: To avoid picking up surface of concrete pick knee boards up with a sliding motion.)

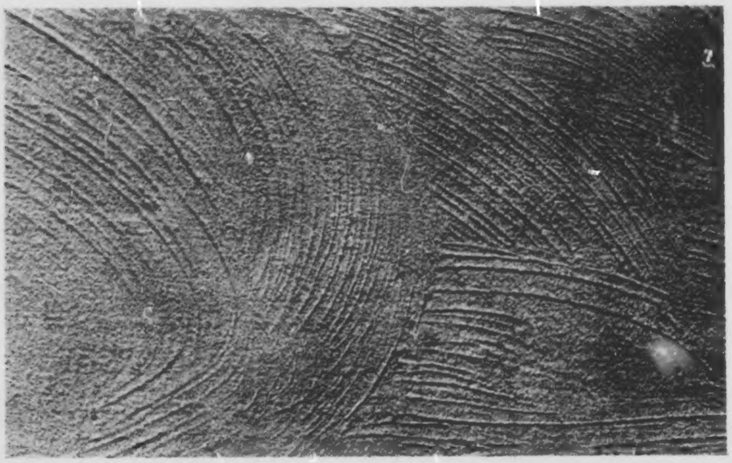
FIGURE 18



JOB SHEET #7

BB. Continue troweling and moving backwards over slab until slab is finished (Figure 19)

FIGURE 19



CC. Apply curing agent using sprayer with nozzle adjusted to a fine mist

DD. Use margin trowel to clean top surface of forms and to clean tools and equipment

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #8--PLACE AND PREPARE SUBBASE SLAB FOR TOPPING

I. Tools and materials

   A. Tools

      1. 12' straightedge
      2. Hand float
      3. Bullfloat
      4. Brooms
      5. Water hose
      6. Margin trowel
      7. Sprayer

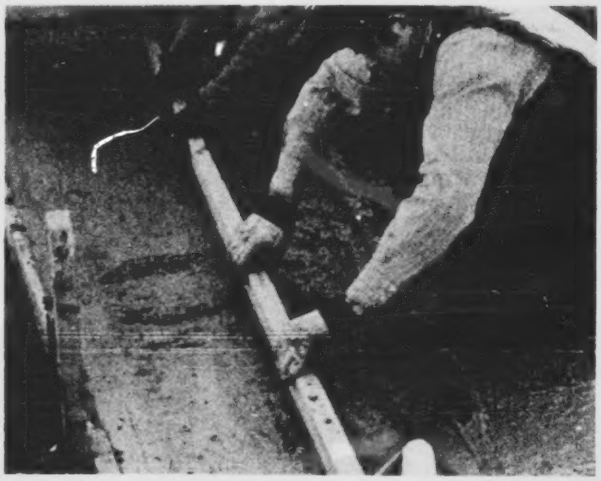
   B. Materials

      1. Concrete
      2. Water
      3. Neat cement or bonding agent
      4. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1

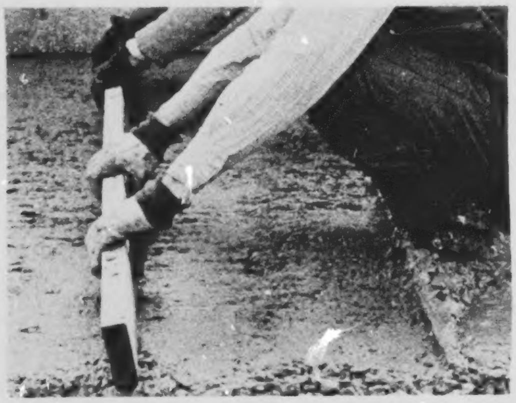


JOB SHEET #8

B. Use straightedge with sawlike motion and rod concrete (Figure 2)

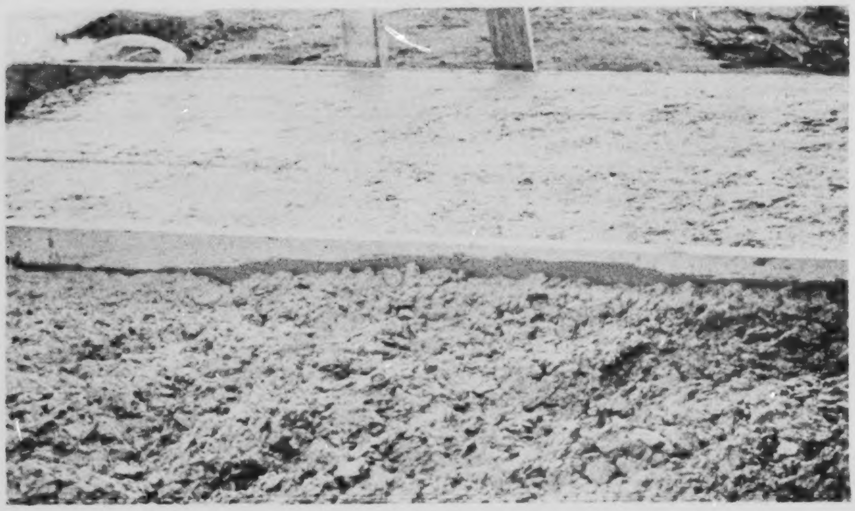
(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind the straightedge to fill holes. See Figure 3.)

FIGURE 3



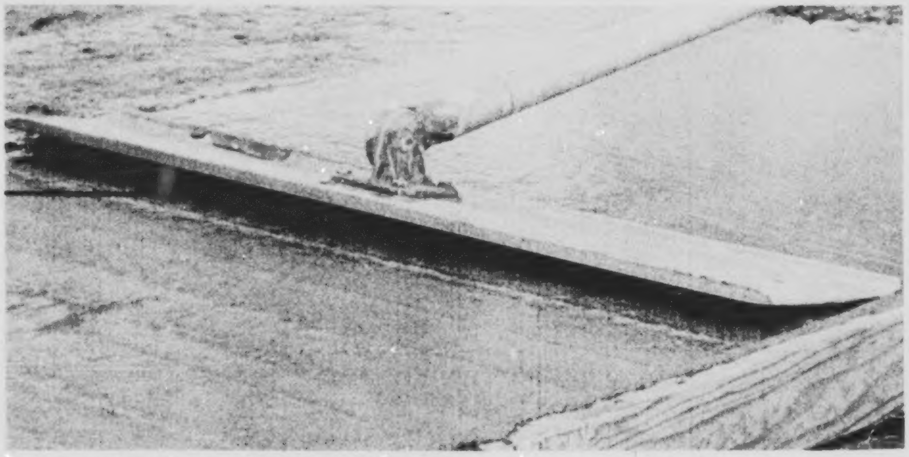
C. Bullfloat surface with a forward and backward movement

(NOTE: Sometimes where topping is being used the bullfloat operation is deleted.)

JOB SHEET #8

D. Position handle of bullfloat so that blade at point A is slightly raised on forward motion (Figure 4)

FIGURE 4



E. Position handle of builfloat so that blade at point B is relatively flat to the surface of the concrete on backward motion (Figure 5)

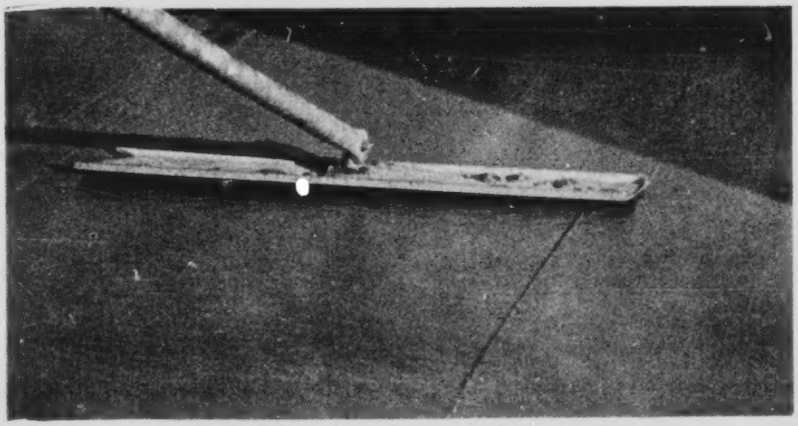
FIGURE 5

F. Overlap previous pass slightly and continue process until entire slab has been completely floated (Figure 6)

(CAUTION: It may be necessary for a time period to elapse before starting brooming operation. Concrete should be hard enough so that broomers will not leave deep impressions.)

JOB SHEET #8

FIGURE 6



G. Roughen surface of base concrete with a heavy fibre or wire broom

H. Broom surface to remove laitance and expose surface aggregate

(NOTE: Two additional methods of preparing hardened concrete for topping are acid etching and using a scarifier.)

I. Clean base concrete

J. Wet down base

(NOTE: Any free water should be removed.)

K. Brush in a cement slurry just ahead of topping placement or brush on a bonding agent

L. Apply curing agent using sprayer with nozzle adjusted to a fine mist

(CAUTION: Be sure to use curing agent that is specified.)

M. Use margin trowel to clean tools and equipment

N. Wash brooms thoroughly in clean water

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #9--FINISH SLAB USING SPECIAL TYPE TOPPING: MONOLITHIC TWO COURSE METHOD

I. Tools and materials

  A. Tools

    1. 12' straightedge

       (NOTE: Magnesium straightedges work best with most toppings.)

    2. Hand float

    3. Hand trowels

       (NOTE: Various sizes of trowels are used. The size of trowel used depends on consistency of concrete and personal preference.)

    4. Rollerbug

    5. Bullfloat

    6. Edger with 3/8" radius

    7. Trowel machine

    8. Margin trowel

    9. Sprayer

  B. Materials

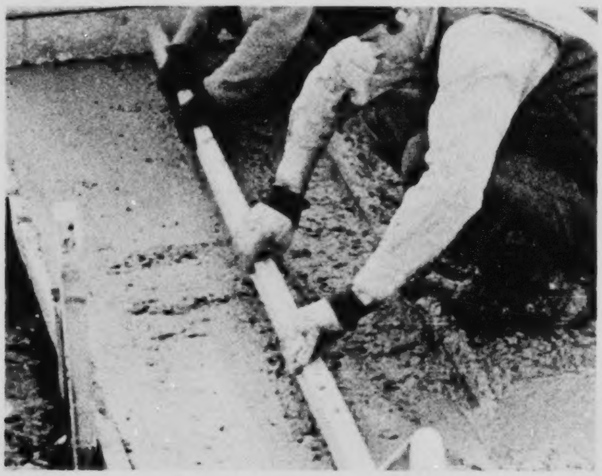
    1. Concrete

    2. Curing agent

II. Procedure

  A. Place concrete at starting point (Figure 1)

FIGURE 1

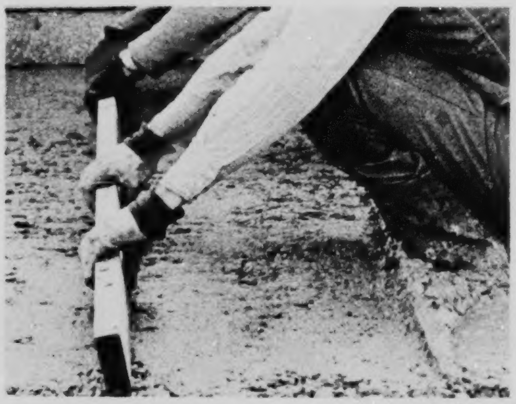


JOB SHEET #9

B. Use straightedge with sawlike motion and rod concrete (Figure 2)

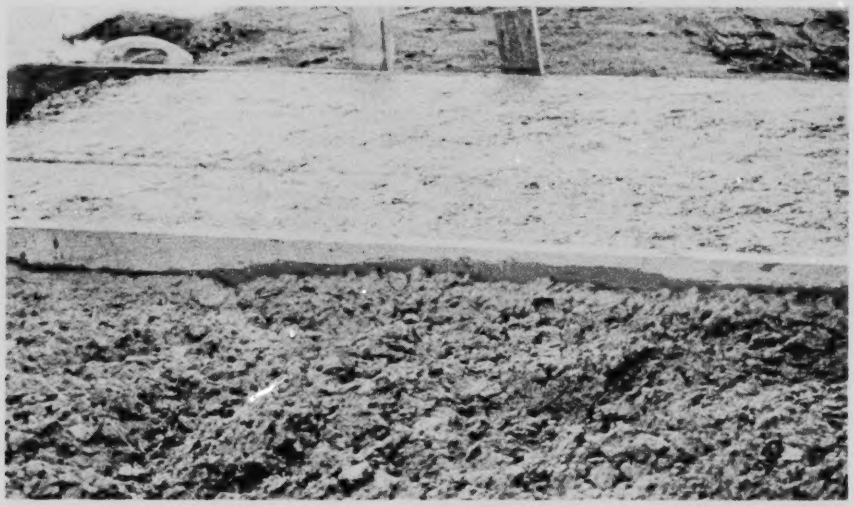
(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

FIGURE 2



(CAUTION: Be sure there is enough concrete behind straightedge to fill holes. See Figure 3.)

FIGURE 3

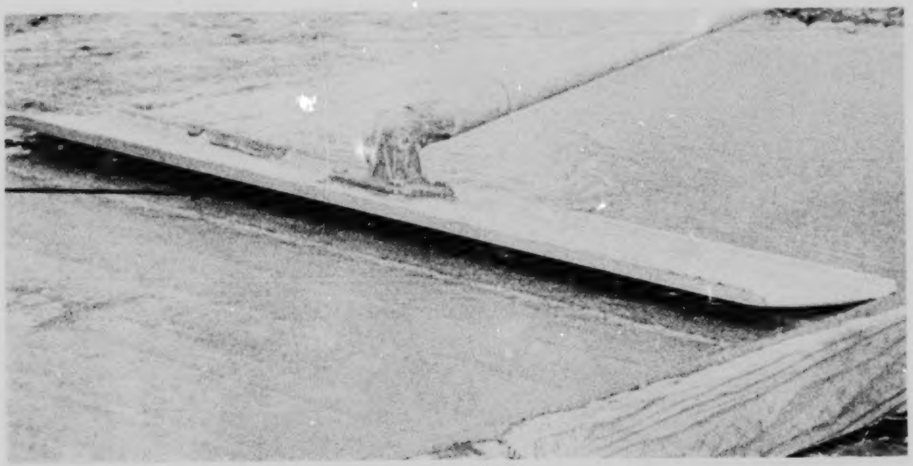


JOB SHEET #9

C. Bullfloat surface with a forward and backward movement

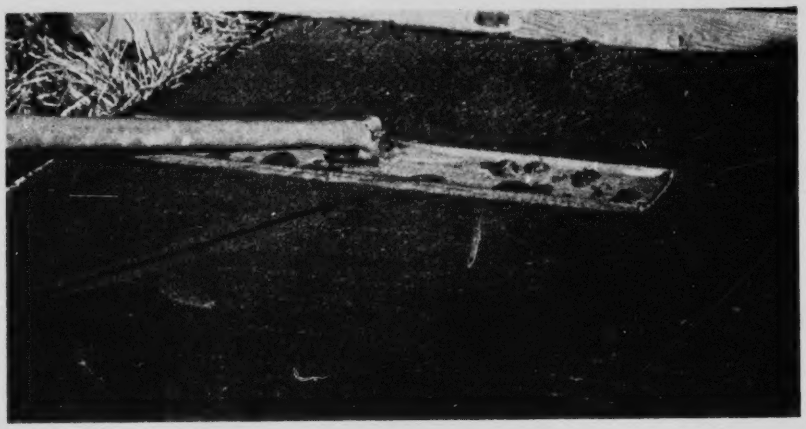
D. Position handle of bullfloat so that blade at point A is slightly raised on forward motion (Figure 4)

FIGURE 4



E. Position handle of bullfloat so that blade at point B is relatively flat to the surface of the concrete on backward motion (Figure 5)

FIGURE 5



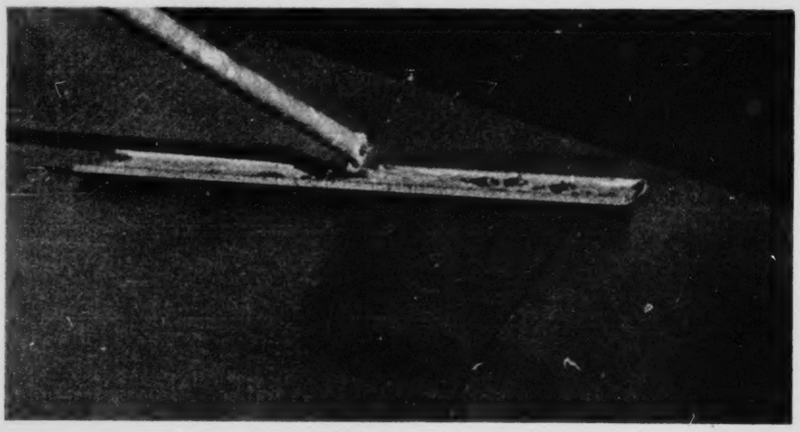
JOB SHEET #9

F. Overlap previous pass slightly and continue process until complete slab has been floated (Figure 6)

(NOTE: Base slab is usually recessed one inch to allow for topping.)

(CAUTION: It may be necessary for a time period to elapse before applying topping to base slab. Base slab should be hard enough to support the men working on it but wet enough to make a good bond.)

FIGURE 6



G. Move topping concrete into place at starting point

H. Use straightedge with sawlike motion and rod topping

(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

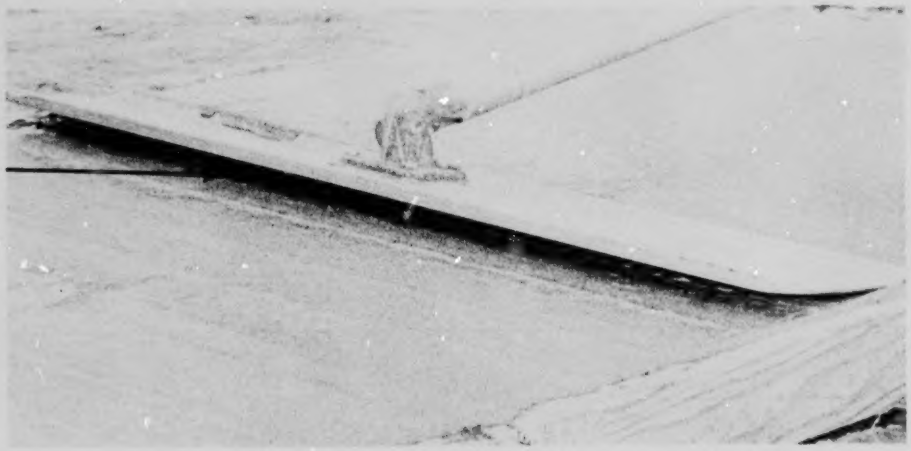
(CAUTION: Be sure there is enough concrete behind straightedge to fill holes.)

I. Bullfloat surface of topping with a forward and backward movement immediately after rodding

JOB SHEET #9

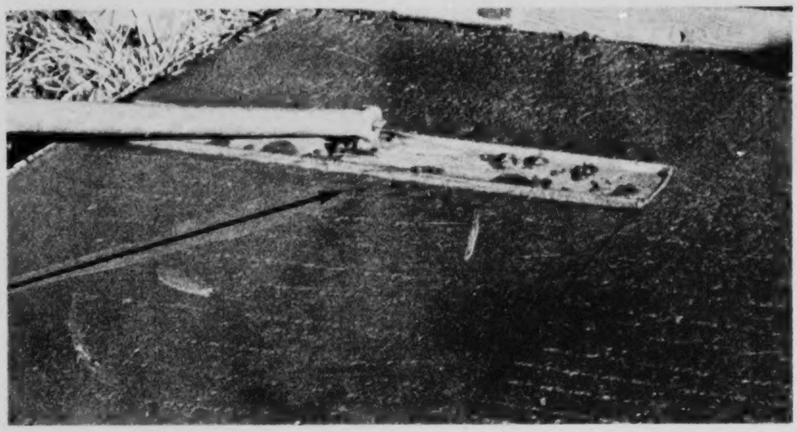
J. Position handle of bullfloat so that blade at point A is slightly raised on forward motion(Figure 7)

FIGURE 7



K. Position handle of bullfloat so that back edge B of float is relatively flat to the surface of the concrete on backward motion (Figure 8)

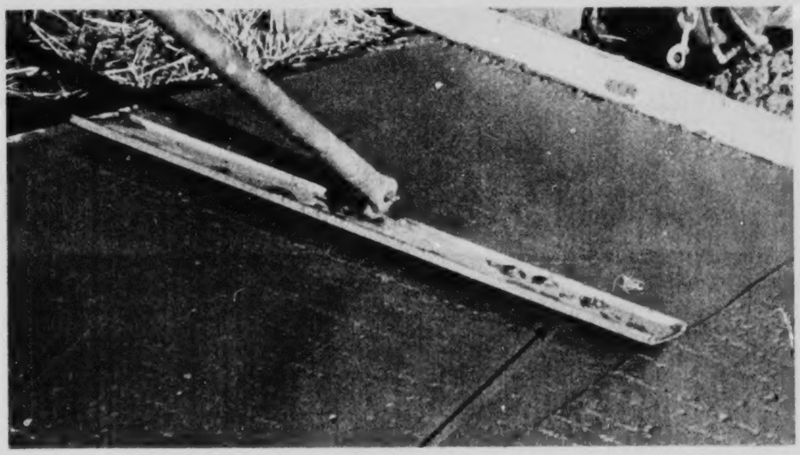
FIGURE 8



JOB SHEET #9

L. Make another pass over first pass, making the backward motion with the handle positioned so that the blade at point B is slightly raised (Figure 9)

FIGURE 9



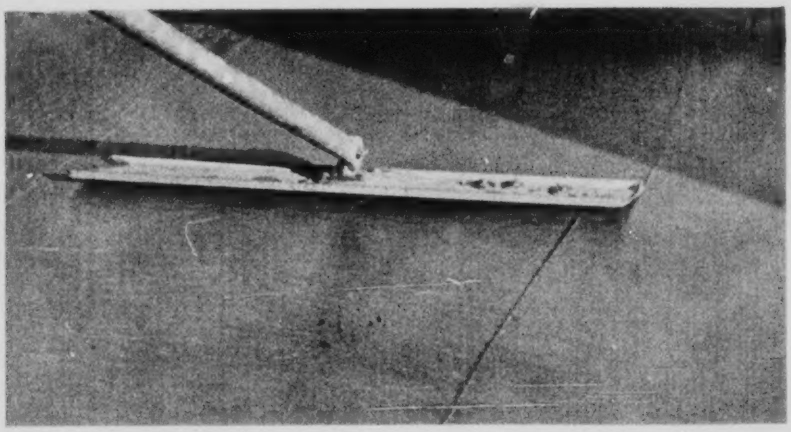
Point B

M. Overlap previous pass slightly and continue process until complete slab has been floated (Figure 10)

(NOTE: Edges usually set faster. Therefore, they should be floated and edged before the rest of the slab.)

(CAUTION: Occasionally, a time period needs to elapse after bullfloating to allow topping to harden and bleed water to leave.)

FIGURE 10



JOB SHEET #9

N. Float edges with float relatively flat and at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places

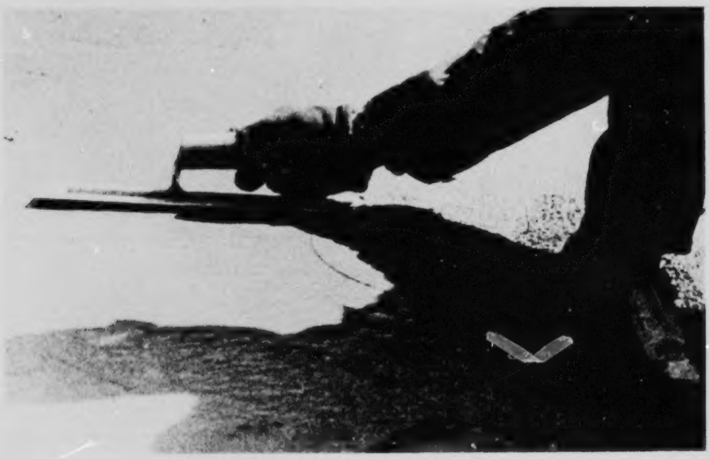
(CAUTION: Keep float at right angles to form when working along edge of forms.)

O. Trowel surface of concrete with finishing trowel immediately after floating an area

(NOTE: Use same method as when floating.)

P. Tilt trowel slightly and with trowel at arm's length, move trowel in a wide semicircular motion until surface is smooth (Figure 11)

FIGURE 11



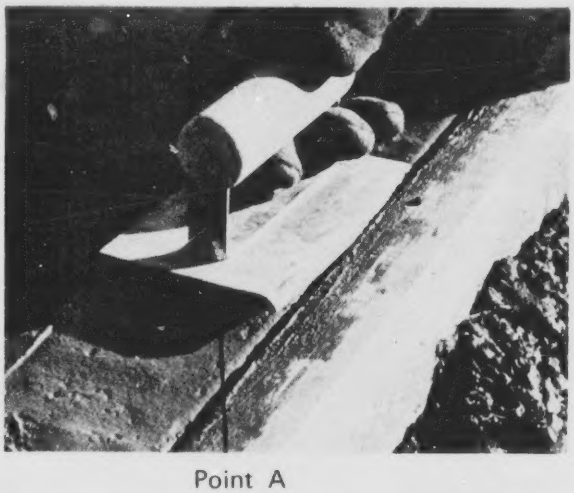
JOB SHEET #9

Q. Continue troweling until all edges have been troweled

R. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 12)

(CAUTION: To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

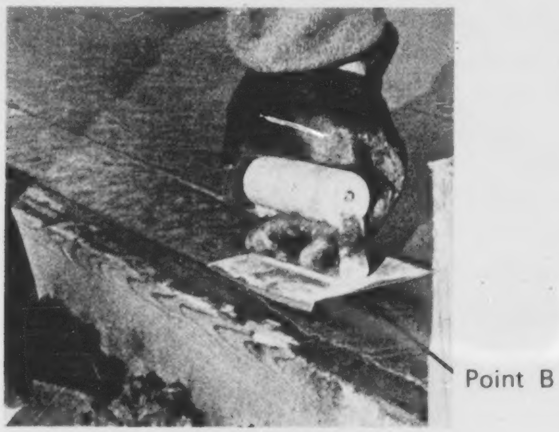
FIGURE 12



S. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 13)

(NOTE: Occasionally, a time period needs to elapse to allow the concrete to harden enough so the machine operators' footprints will leave only slight impressions.)

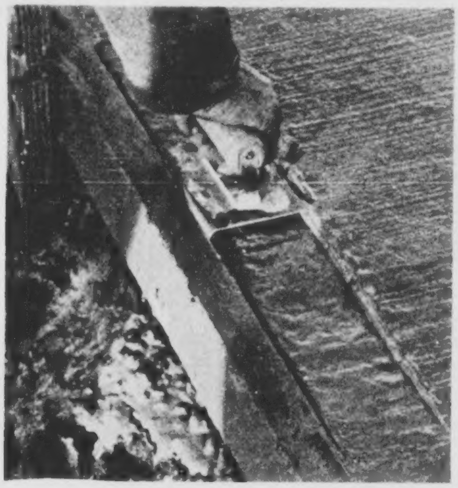
FIGURE 13



JOB SHEET #9

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 14.)

FIGURE 14

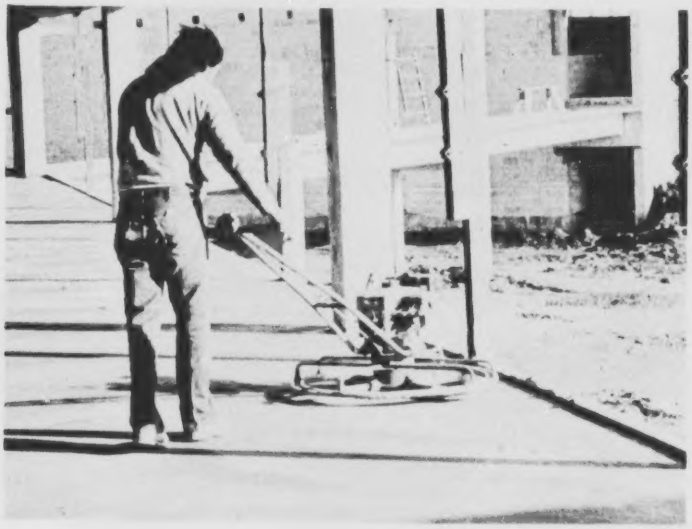


T. Continue until all edges are rounded and smooth

U. Position trowel machine with float blades at hardest point of concrete slab
(NOTE: For toppings, a small lightweight machine is preferable.)

V. Start machine and move machine from right to left and back again (Figure 15)

FIGURE 15



JOB SHEET #9

(NOTE: To move machine to the left, raise handle slightly; to move machine to the right, lower handle slightly. See Figure 16.)

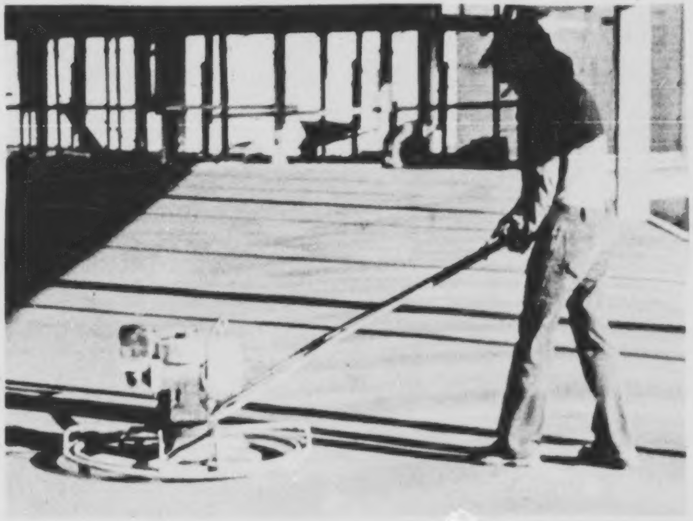


FIGURE 16

W. Make second pass of machine by moving backwards and slightly lapping first pass (Figure 17)

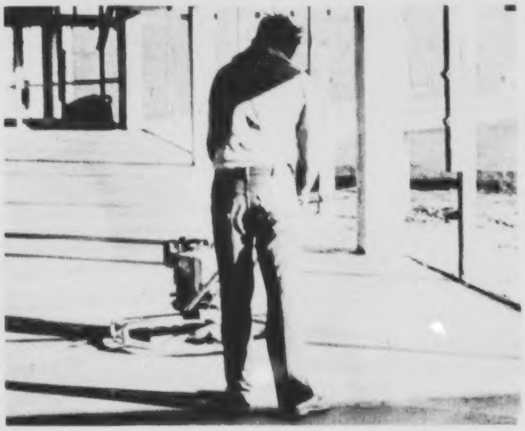


FIGURE 17

JOB SHEET #9

X. Continue floating out all footprints and imperfections until slab is finished

(NOTE: Often it is necessary to refloat a slab because it is not setting fast enough. If this is the case, refloat the surface starting at hardest point, operating machine in a right to left pattern, and moving backwards until slab has been finished. Allow enough time after each machining for concrete to air out so that it will harden enough to warrant troweling again.)

Y. Use trowel machine with trowel blades and again go over slab, working from right to left and moving backwards slightly lapping first pass

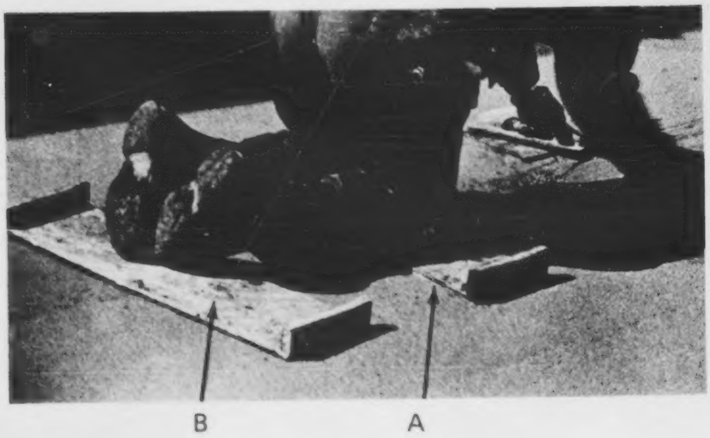
Z. Retrowel edges and rerun edger taking same precautions as to tilting and picking up edger

(NOTE: For hard trowel finish, the machine troweling process may have to be done several times. Allow enough time before last troweling so that desired finish can be obtained. Each machining should be done by working at right angles to previous machining.)

AA. Place knee boards at location of hardest area and position body so that both knees are on knee board A with toes positioned on knee board B (Figure 18)

(NOTE: Use this method if hand trowel finish is specified.)

FIGURE 18



JOB SHEET #9

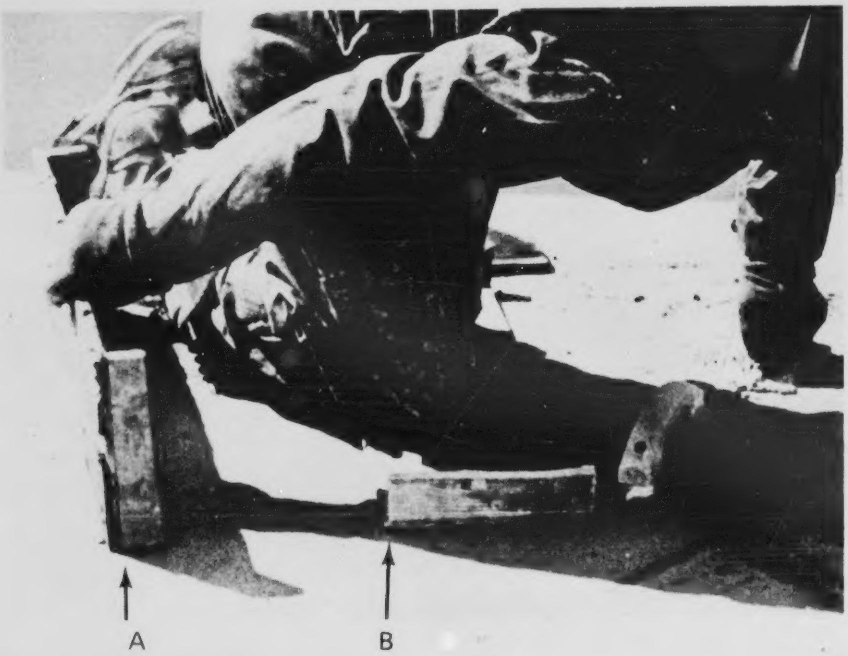
BB. Obtain balance on knee board by leaning on trowel in left hand and reaching out at arm's length with right hand

CC. Trowel surface with semicircular motion and keep trowel tilted slightly

DD. Move backwards across slab by placing knees on knee board B, picking up knee board A, and placing it behind knee board B (Figure 19)

(CAUTION: To avoid picking up surface of concrete pick up knee boards with a sliding motion.)

FIGURE 19



EE. Continue troweling and moving backwards over slab until slab is finished

FF. Apply curing agent using sprayer with nozzle adjusted to a fine spray

GG. Use margin trowel to clean top surface of forms and to clean tools and equipment

FINISHING CONCRETE FLOORS
UNIT II

JOB SHEET #10--FINISH SLAB USING SPECIAL TYPE TOPPING: MONOLITHIC DRY SHAKE METHOD

I. Tools and materials

A. Tools

1. 12' straightedge
2. Hand float
3. Hand trowels

   (NOTE: Various sizes of trowels are used. The size of trowel used depends on consistency of concrete and personal preference.)
4. Rollerbug
5. Bullfloat
6. Edger with 3/8" radius
7. Trowel machine and/or float machine
8. Margin trowel
9. Wheelbarrow
10. Long-handled shovel
11. Buckets
12. Water hose
13. Sprayer

B. Materials

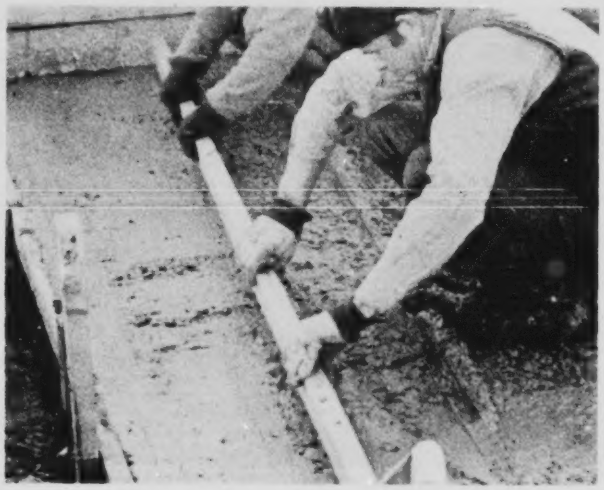
1. Concrete
2. Special topping (dry shake)
3. Curing agent

JOB SHEET #10

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

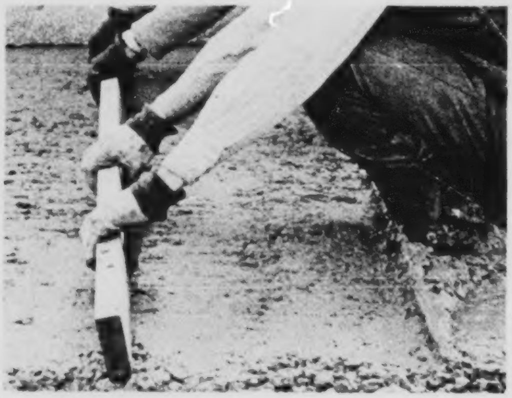


B. Use straightedge with sawlike motion and rod concrete

(NOTE: Straightedge must be from one to two feet longer than widest distance to be straightedged.)

(CAUTION: Be sure there is enough concrete behind the straightedge to fill holes. See Figure 2.)

FIGURE 2

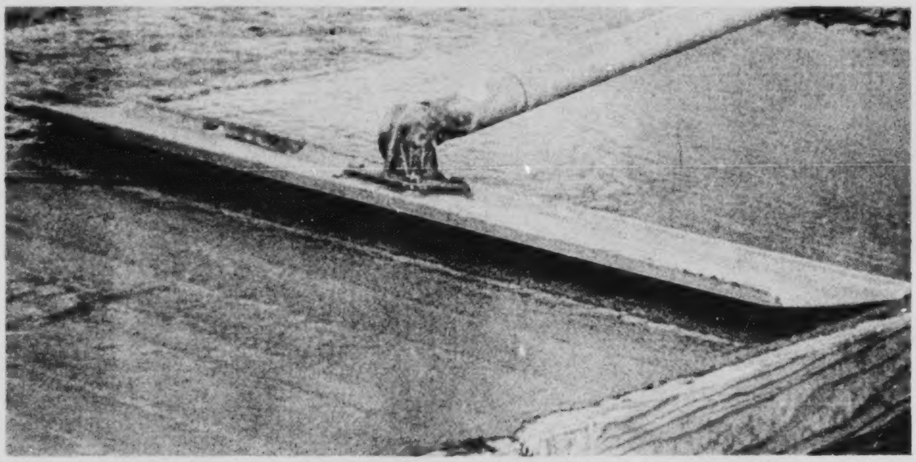


C. Bullfloat surface with a forward and backward movement

JOB SHEET #10

D. Position handle of bullfloat so that blade at point A is slightly raised on forward motion (Figure 3)

FIGURE 3



E. Position handle of the bullfloat so that blade at point B is relatively flat to the surface of the concrete on backward motion (Figure 4)

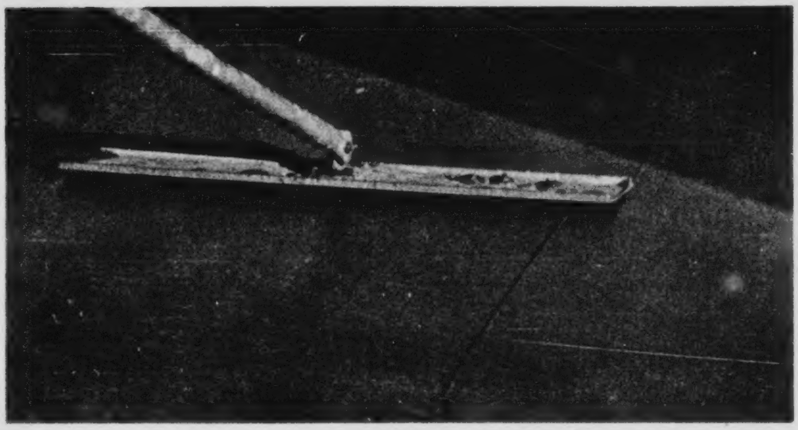
FIGURE 4

JOB SHEET #10

F. Overlap previous pass slightly and continue process until complete slab has been floated (Figure 5)

(CAUTION: It may be necessary for a time period to elapse before applying topping to base slab.)

FIGURE 5



G. Stretch water hose across slab to pull bleed water off if it is still present

(NOTE: First shake of topping material can be applied using either shovel and wheelbarrow or hand and bucket, depending on type of material.)

H. Apply first shake on slab using about two-thirds of material specified, applying it so that it is distributed evenly over entire slab

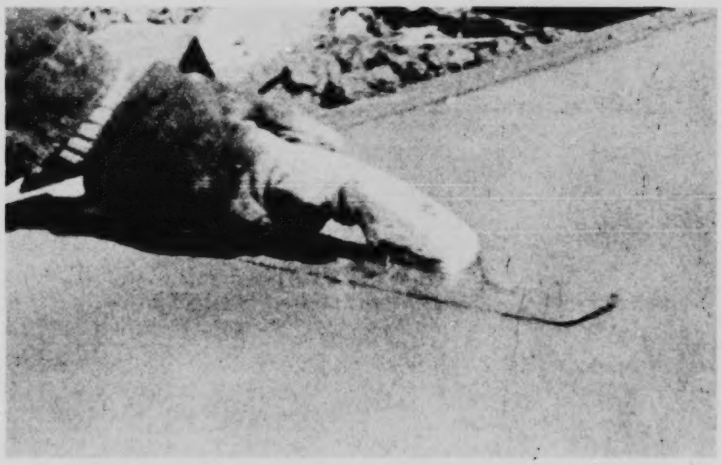
I. Float first shake into base as soon as it has taken on enough moisture

(NOTE: Edges usually set faster; therefore, they should be floated and edged before the rest of the slab.)

JOB SHEET #10

J. Float edges with float relatively flat and at arm's length; move in a wide semicircular motion until surface is smooth of high and low places and dry shake is worked into base slab (Figure 6)

FIGURE 6



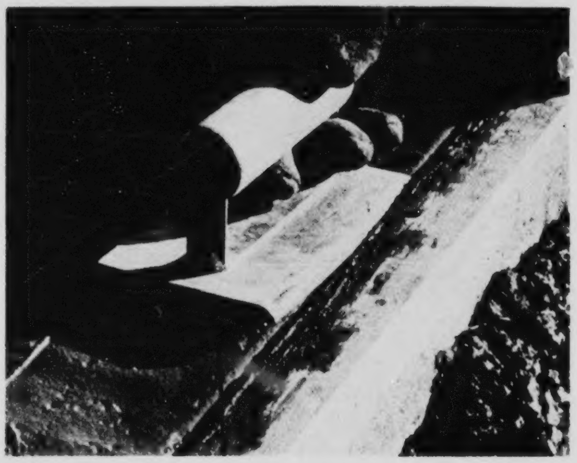
K. Continue floating until all edges have been worked

(CAUTION: Keep float at right angles to form when working along edge of form.)

L. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 7)

(CAUTION: To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 7

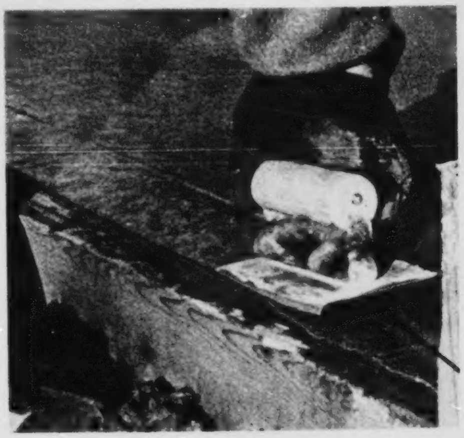


Point A

JOB SHEET #10

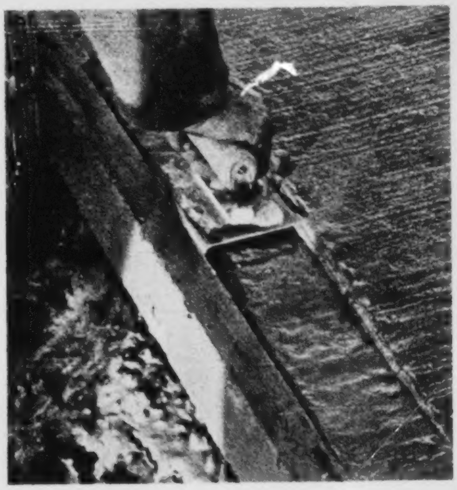
M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 8)

FIGURE 8



(CAUTION: To avoid low places do not put too much pressure on edger. See Figure 9.)

FIGURE 9

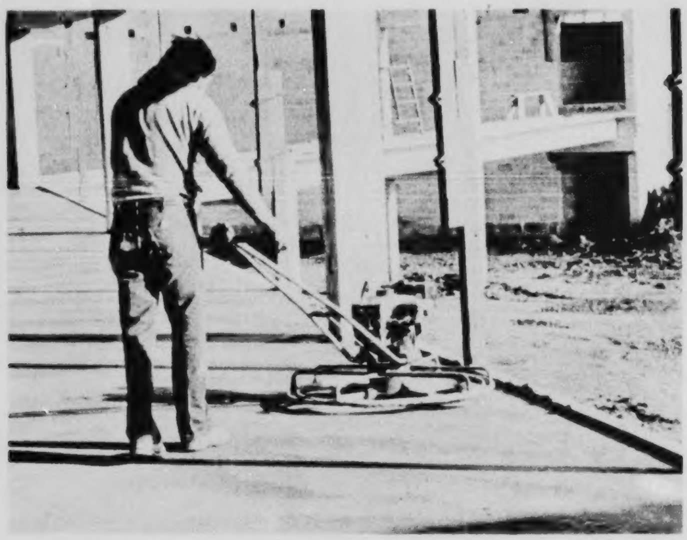


N. Continue until all edges are rounded and smooth

O. Use mechanical float, either trowel machine with float blades or kelly type machine, and position machine at hardest point of slab

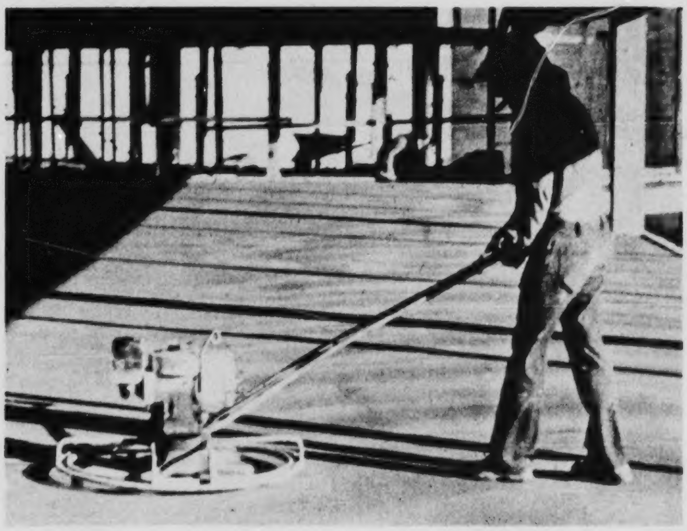
P. Start machine and move across slab from right to left and back again (Figure 10)

FIGURE 10



(NOTE: To move machine to the left, raise handle slightly; to move machine to right, lower handle slightly. See Figure 11.)

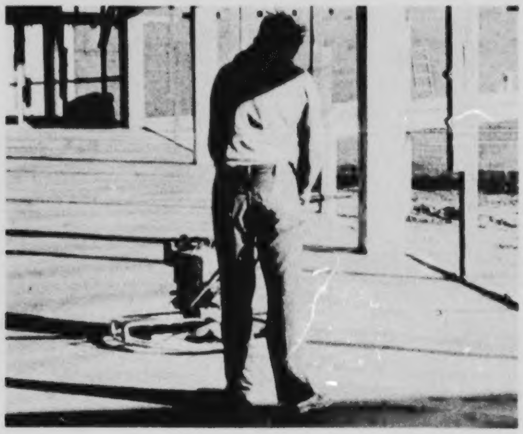
FIGURE 11



JOB SHEET #10

Q. Make second pass of machine by moving backwards and slightly lapping first pass (Figure 12)

FIGURE 12



R. Continue floating out all footprints and working in topping until entire slab has been floated

S. Apply remaining one third of material after floating of first shake and while there is sufficient surface moisture

(NOTE: Be careful to spread shake evenly.)

T. Start floating edges and working in shake again

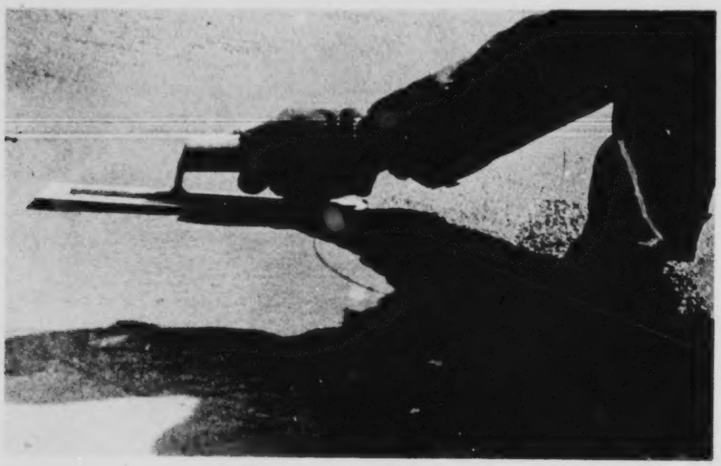
U. Float edges with float relatively flat and at arm's length, moving float in a wide semicircular motion until surface is smooth of high and low places and topping is worked in

JOB SHEET #10

V. Trowel surface of concrete with finishing trowel slightly tilted and at arm's length; move trowel in wide semicircular motion until surface is smooth (Figure 13)

(NOTE: This step should be done immediately after floating an area.)

FIGURE 13

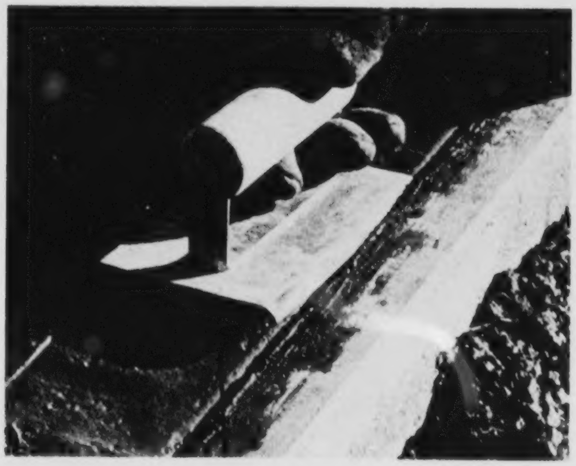


W. Continue troweling until all edges have been troweled

X. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 14)

(CAUTION: To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

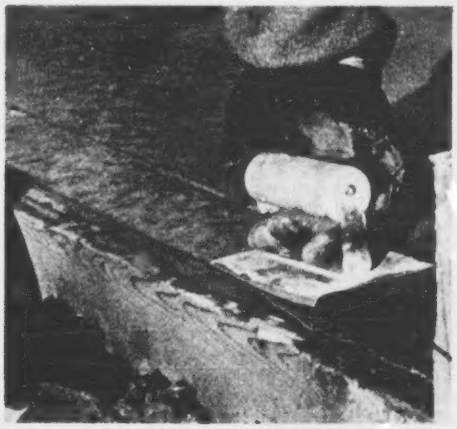
FIGURE 14



JOB SHEET #10

Y. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 15)

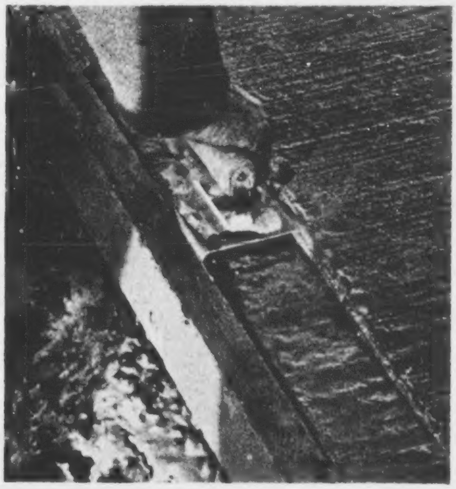
FIGURE 15



Point B

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 16.)

FIGURE 16



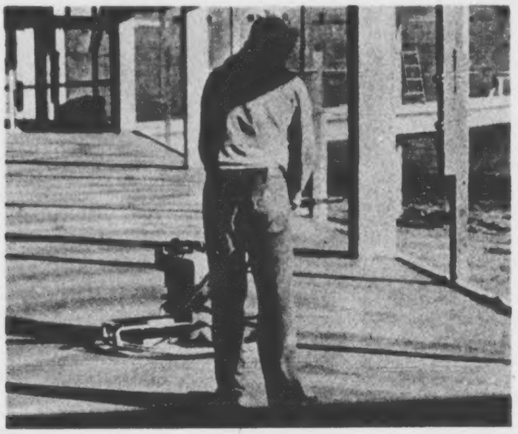
Z. Continue until all edges are rounded and smooth

JOB SHEET #10

AA. Use float machine and again start at hardest point, working from right to left, moving backwards, and slightly lapping first pass (Figure 17)

(NOTE: Each machining should be done by working at right angles to previous machining.)

FIGURE 17



BB. Continue floating until all topping has been worked in

(NOTE: Often it is necessary to refloat a slab because it is not setting fast enough. If this is the case, refloat surface starting at hardest point. Operate machine in a right to left pattern, moving backwards until slab has been finished. Allow enough time after each machining for concrete to harden enough to warrant troweling again.)

CC. Use trowel machine and go over slab, working from right to left and moving backwards lapping first pass slightly

DD. Retrowel edges and rerun edger, taking same precautions as to tilting and picking up edger

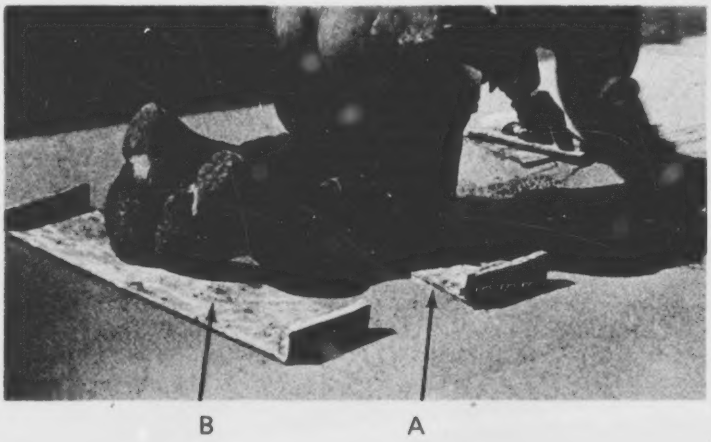
(NOTE: In most cases where toppings are used, specifications call for hard trowel finish. When this is the case, the troweling process may have to be done several times. If so, remember to start at hardest point and work from right to left, moving backwards over slab. As concrete hardens and troweling continues, the trowel blades can be tilted slightly higher.)

JOB SHEET #10

EE. Place knee boards at location of hardest area and position body so that both knees are on knee board A with toes positioned on knee board B (Figure 18)

(NOTE: Use this method if hand trowel finish is specified.)

FIGURE 18



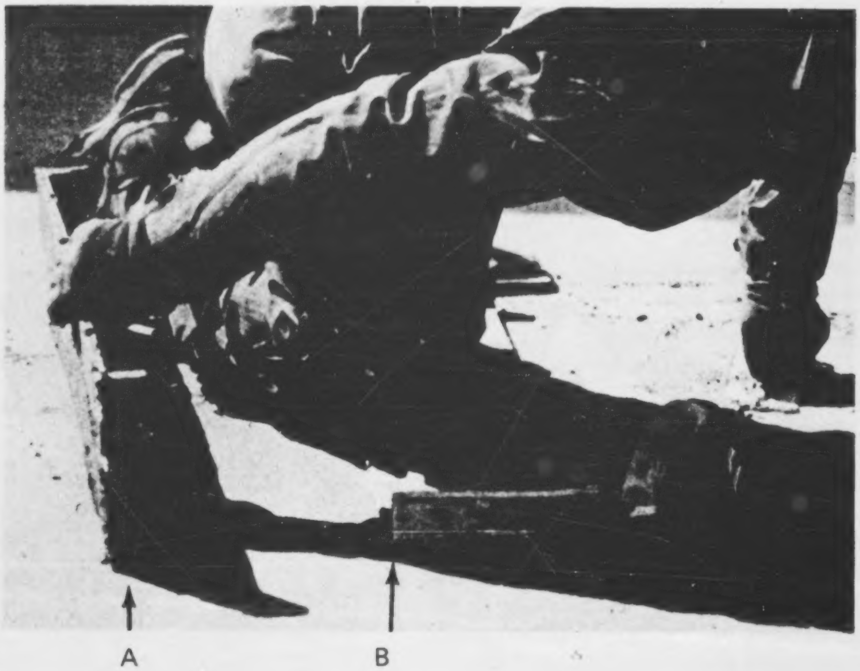
FF. Obtain balance on knee boards by leaning on a trowel in left hand and reaching out at arm's length with right hand, troweling surface with a wide semicircular motion and keeping trowel tilted slightly

GG. Move backwards across slab by placing knees on knee board B, picking up knee board A, and placing it behind knee board B (Figure 19)

JOB SHEET #10

(CAUTION: Avoid picking knee boards straight up.)

FIGURE 19



HH. Continue troweling and moving backwards over slab until slab is finished

II. Apply curing agent using sprayer with nozzle adjusted to a fine mist

JJ. Use margin trowel to clean top surface of forms and to clean tools and equipment

FINISHING CONCRETE FLOORS
UNIT II

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. (Terms and definitions are continued on next page.)

_____a. Tool used to consolidate or compact concrete

_____b. Tool used to kneel on while finishing concrete

_____c. Stiff concrete

_____d. Film on surface of concrete

_____e. Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

_____f. Detailed set of written instructions which explains the drawing, describes material and equipment used in the structure as to quality and types, and becomes part of the contract

_____g. Pure cement (without anything added)

_____h. Continuous mass of concrete cast as a single unit

_____i. Process of troweling concrete and leaving surface with a fuzzy fanlike pattern

_____j. Process of troweling concrete to a very hard, smooth surface

_____k. Slump (firmness or wetness) of fresh concrete

_____l. Type of finish designed by running broom across surface leaving grooves or pattern in concrete

_____m. Process of leveling high spots and/or ridges left by straightedge

1. Fines
2. Topping
3. Bleed water
4. Edging
5. Floating
6. Rodding and/or dragging off
7. Darbying
8. Slab
9. Water sheen
10. Jitterbugging
11. Subgrade
12. Troweling
13. Low slump
14. Broom finish
15. Bonding agent
16. Burnish finish
17. Neat cement
18. Monolithic
19. Laitance
20. Consistency

______n. Process of straightedging or rodding concrete to a specific grade

______o. Generally, a commercial mixture used to top floor surfaces to provide durability, safety, and beauty

______p. Process of consolidating or compacting concrete

______q. Lustrous surface imparted by the evaporation of the bleed water

______r. Process of leveling out surface of concrete by cutting off high spots and filling low places

______s. Water that comes to the surface of concrete after the concrete has been placed

______t. Process of leveling surface of concrete to a smooth, dense finish

______u. Soil prepared and compacted to support a structure or a pavement system

______v. Process of smoothing and rounding the edges of concrete

______w. Poured concrete floor

______x. Material or paste worked to the surface

______y. Tool used to level high spots and/or ridges left by straightedge

______z. Very wet mixture of sand, cement, and water

____aa. Application of a dry topping material

____bb. Method of cleaning concrete by scrubbing with acid and rinsing with clear water

____cc. Tool or machine used to chip the surface of concrete

21. Specifications

22. Swirl finish

23. Rollerbug

24. Knee boards

25. Acid etch

26. Slurry

27. Scarifier

28. Darby

29. Shake

2. Match the special types of toppings on the right to their uses on left. Place correct numbers in blanks provided.

______a. Used where floors are subjected to high abrasion, usually in industrial plants

______b. Used primarily in heavy industry where the damage from impact is evident

______c. Used in explosive manufacturing plants, aircraft hangers, hospital operating rooms, and other areas where static charges are dangerous

______d. Used mainly in institutions and hospitals

______e. Used nearly anywhere to enhance the appearance of concrete; also used to mark off special areas, such as aisles and hazardous areas in industrial plants

1. Colored
2. Abrasion resistant
3. Vermin proof
4. Impact resistant
5. Spark resistant (static disseminating)

3. Select from the list below five types of floor finishes. Place an "X" in correct blanks.

______a. Cement paint

______b. Broom finish

______c. Hand trowel

______d. Rubbed finish

______e. Burnish finish

______f. Sandblast finish

______g. Stone finish

______h. Swirl finish

______i. Grinder finish

______j. Machine finish

4. Arrange in order the steps to take when placing and finishing a concrete slab. Put a "1" in front of the first step, a "2" in front of the second step, and so on.

______a. Darby or bullfloat

______b. Hand float

______c. Trowel

______d. Rod

______e. Edge

______f. Finish

______g. Jitterbug

5. Name four variables to consider before floating a slab.

a.

b.

c.

d.

6. Select from the list below four factors to look for before finishing. Circle correct letters.

   a. Bleed water gone

   b. Temperature of bleed water

   c. Concrete not setting

   d. Glossy appearance not noticeable

   e. Water sheen disappeared

   f. Weather forecast

   g. Concrete stiffening

7. Discuss in a short paragraph the purpose for consolidating concrete.

8. Distinguish between rodding and jitterbugging. Place an "X" by statement that represents rodding.

   ______a. Process of consolidating or compacting concrete

   ______b. Process of straightedging concrete to a specific grade

9. State the reasons for floating a slab.

   a.

   b.

   c.

   d.

10. Discuss in a few words the reasons for troweling a slab.

11. Discuss in a few words what is meant by premature troweling.

12. Select from the list below three defects caused by premature and excessive finishing. Place an "X" in the blanks.

______a. Spalling

______b. Scaling

______c. Crazing

______d. Cracking

______e. Dusting

13. Demonstrate the ability to:

a. Finish small slab with float finish.

b. Finish large slab with float finish.

c. Finish slab with rough broom finish.

d. Finish slab with hand trowel.

e. Finish slab with fine broom finish.

f. Finish slab using trowel machine.

g. Finish slab with swirl finish: Sweat trowel.

h. Place and prepare subbase slab for topping.

i. Finish slab using special type topping: Monolithic two course method.

j. Finish slab using special type topping: Monolithic dry shake method.

(NOTE: If the above activities have not been accomplished prior to test, ask your instructor when they should be completed.)

FINISHING CONCRETE FLOORS
UNIT II

ANSWERS TO TEST

1.
   - a. 23
   - b. 24
   - c. 13
   - d. 19
   - e. 15
   - f. 21
   - g. 17
   - h. 18
   - i. 22
   - j. 16
   - k. 20
   - l. 14
   - m. 7
   - n. 6
   - o. 2
   - p. 10
   - q. 9
   - r. 5
   - s. 3
   - t. 12
   - u. 11
   - v. 4
   - w. 8
   - x. 1
   - y. 28
   - z. 26
   - aa. 29
   - bb. 25
   - cc. 27

2.
   - a. 2
   - b. 4
   - c. 5
   - d. 3
   - e. 1

3. b, c, e, h, j

4.
   - a. 3
   - b. 4
   - c. 6
   - d. 1
   - e. 5

f. 7

g. 2

5. a. Concrete temperature

   b. Air temperature

   c. Relative humidity

   d. Wind

6. a, d, e, g

7. To provide a uniform dense mass without any air voids or stone pockets

8. b

9. a. Level out all imperfections

   b. Cut off high places

   c. Fill in low places

   d. Bring fines to surface

10. Discussion should include the following points.

    a. To bring surface to smooth, dense finish

    b. To provide desired appearance, texture, and hardness that is specified

11. Starting to finish concrete before the water sheen has left the surface or before the concrete has hardened sufficiently

12. b, c, e

13. Performance skills evaluated to the satisfaction of the instructor

FINISHING CONCRETE ROOFS
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match the types of roofs to their methods of construction. He should be able to name the benefits of using types of thin shell roofs and to distinguish between short barrel and long barrel shell construction. He should be able to demonstrate the ability to place and finish a reinforced cast-in-place umbrella type roof. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with finishing concrete roofs to the proper definitions.
2. Match the types of roofs to their methods of construction.
3. Identify four types of thin shell roofs.
4. Distinguish between short barrel and long barrel shell construction.
5. Identify the types of hyperbolic paraboloid roofs.
6. Name three types of folded plate roofs.
7. Discuss in a few words what is meant by a dome shell.
8. Name the methods of concrete stressing.
9. Name the benefits of using types of thin shell roofs.
10. Select from a list types of lightweight concrete used on roofs.
11. Select from a list factors to consider when pouring a roof slab.
12. Demonstrate the ability to place and finish a reinforced cast-in-place umbrella type roof.

FINISHING CONCRETE ROOFS
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Contact Portland Cement Association for films.
- G. Demonstrate and discuss procedure outlined in the job sheet.
- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedure outlined in the job sheet.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Types of Thin Shell Roofs
  2. TM 2--Types of Thin Shell Roofs (Continued)

D. Job Sheet #1--Place and Finish a Reinforced Cast-in-Place Umbrella Type Roof

E. Test

F. Answers to test

II. References:

A. Riles, Wilson. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1972.

B. *Concrete Technology.* Skokie, Illinois: Portland Cement Association, 1965.

III. Films:

A. "New Shapes in Concrete." Portland Cement Association, Skokie, Illinois 60076.

B. "Concrete in the Sixties." Portland Cement Association, Skokie, Illinois 60076.

FINISHING CONCRETE ROOFS
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Thin shell--Very thin poured slab usually about two and one half inches thick

   B. Barrel shells--Rolled type roofs, such as on aircraft hangers

   C. Hyperbolic paraboloid--Shape of double curvature with surface curved on two planes

   D. Folded plate--Roof shaped like a V, Z, or modified W

   E. Lightweight concrete--Concrete made either by using gas-generating chemicals or by using lightweight aggregate which will weigh from 15 to 130 pounds per cubic foot

   F. Reinforcing--Steel bars or welded wire fabric positioned in concrete to increase the tensile strength of concrete

   G. Monolithic--Continuous mass of concrete cast as a single unit

   H. Precast--Concrete cast in forms either at job site or at plant, cured, and then hoisted in place

   I. Post-tensioning--Process of stressing concrete member after it is placed and hardened by stretching steel cables through ducts in concrete

   J. Pretensioning--Process of stretching steel wire through concrete and releasing it after concrete hardens to trasmit compressive stress to the concrete

   K. Prestressed concrete--Process of compressing concrete by stretching steel wires or cables through the concrete member by methods of post-tensioning and pretensioning

   L. Low slump--Stiff concrete

   M. Knee boards--Tool used to kneel on while finishing concrete

   N. Floating--Process of leveling out surface of concrete by cutting off high spots and filling low places

   O. Darby--Tool used to level high spots and/or ridges left by straightedge

   P. Darbying--Process of leveling high spots and/or ridges left by straightedge

INFORMATION SHEET

II. Types of roofs and their methods of construction

   A. Precast monolithic--Prepared on ground or in plant and raised into position

   B. Reinforced cast-in-place--Placed, rodded, and finished directly in place over beams and/or trusses

   C. Prestressed--Cast at factory and/or on job using steel wire stretched in the concrete to compress concrete and support load

   D. Thin shell--Poured in place in very thin sections

   (NOTE: Some shells have been built as thin as 5/8".)

III. Types of thin shell roofs (Transparencies 1 and 2)

   A. Barrel

      1. Long barrel shell

      2. Short barrel shell

   B. Hyperbolic paraboloid

      1. Saddle type

      2. Umbrella type

   C. Dome

   D. Folded plate

IV. Short barrel shell vs. long barrel shell construction

   A. Short barrel shell--Large chord width in proportion to the span between ribs

   B. Long barrel shell--Short chord width compared to the span between supporting ribs

V. Types of hyperbolic paraboloid roofs

   A. Saddle

   B. Umbrella

INFORMATION SHEET

VI. Types of folded plate roofs

   A. V-shaped

   B. Z-shaped

   C. W-shaped

VII. Dome shell--Portion of a sphere that is symmetrical and spacious

VIII. Methods of concrete stressing

   A. Post-tension

   B. Pretension

IX. Benefits of using types of thin shell roofs

   A. Saves material

   B. Reduces reinforcement

   C. Reduces size of supporting columns

   D. Reduces form cost

X. Types of lightweight concrete used on roofs

   A. Insulating

   B. Structural lightweight

   C. Semi-lightweight

XI. Factors to consider when pouring a roof slab

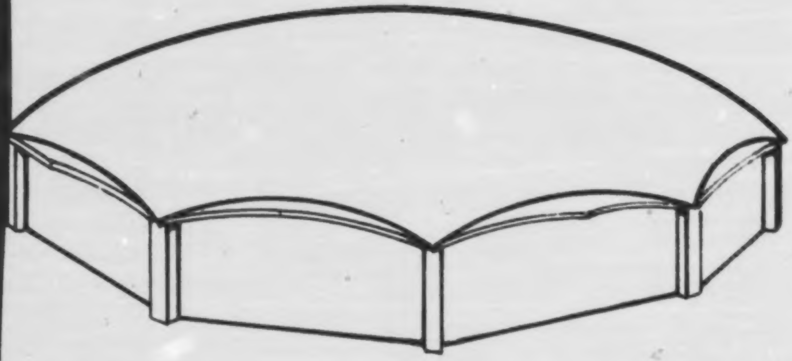
   A. Correct mix

   B. Correct grade or elevation

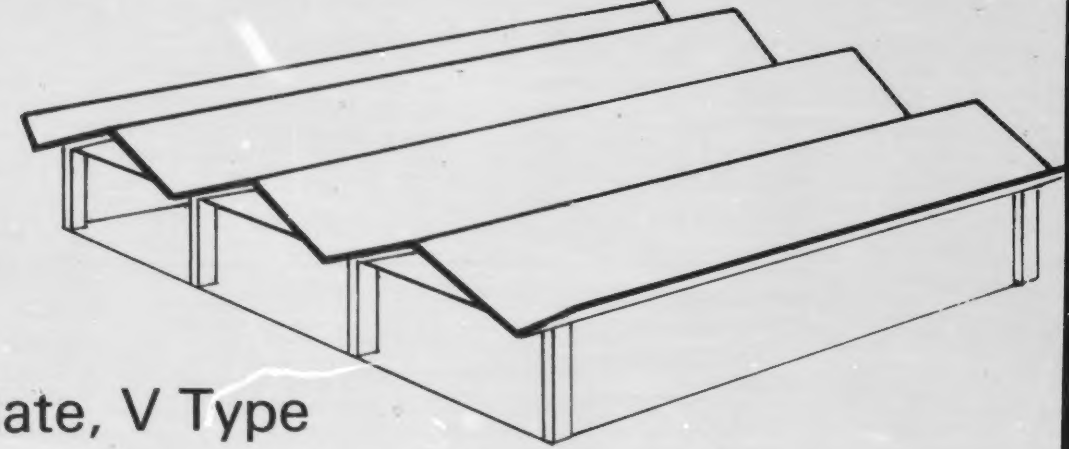
   C. Variation in thickness to allow adequate drainage

   D. Slump

Types of Thin Shell Roofs



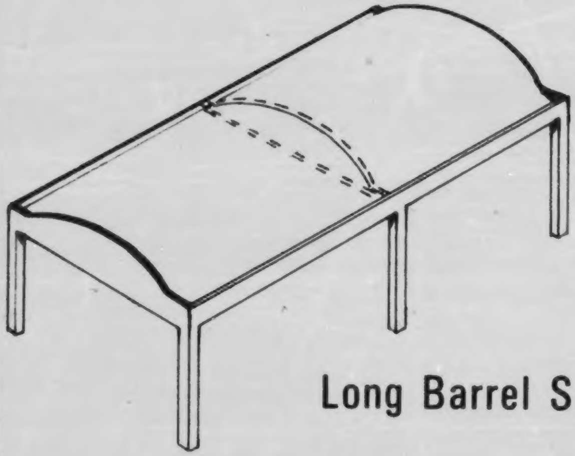
Dome



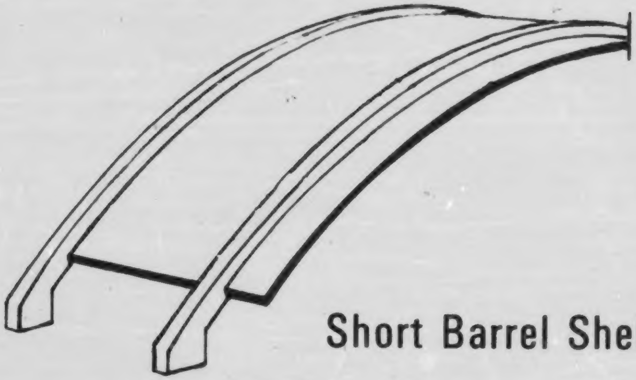
Folded Plate, V Type

Types of Thin Shell Roofs

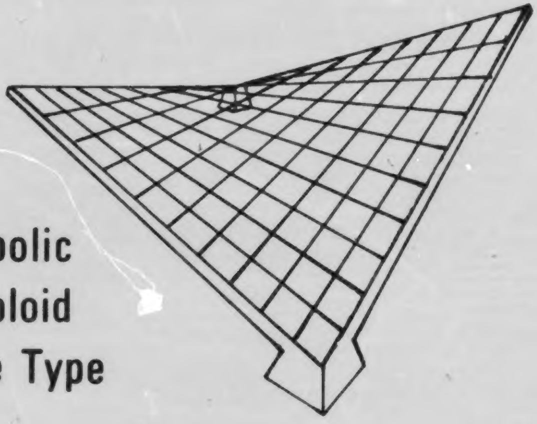
(Continued)



Long Barrel Shell

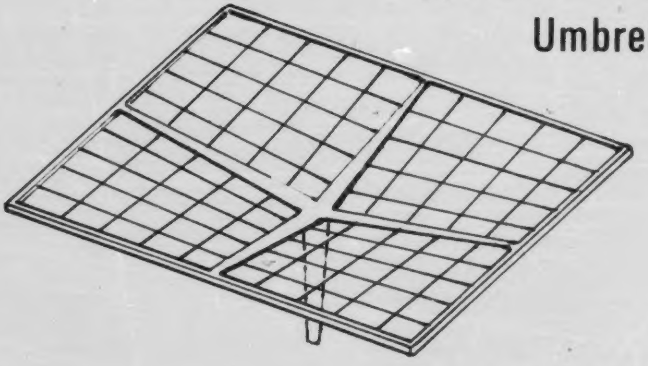


Short Barrel Shell



yperbolic
araboloid
addle Type

Hyperbolic Paraboloid
Umbrella Type



FINISHING CONCRETE ROOFS
UNIT III

JOB SHEET #1--PLACE AND FINISH A REINFORCED CAST-IN-PLACE UMBRELLA TYPE ROOF

I. Tools and materials

  A. Tools

    1. Straightedges

    (NOTE: Several sizes of straightedges will be needed because of the pie-shaped sections to be rodded.)

    2. Darby

    3. Hand float

    4. Knee boards

    5. Margin trowel

    6. Sprayer

  B. Material

    1. Concrete

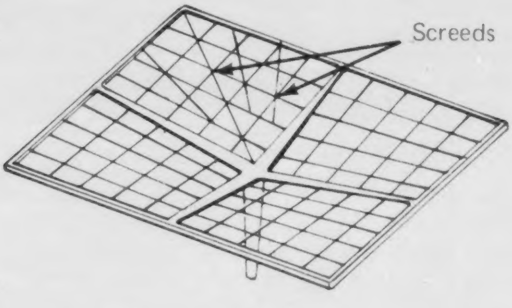
    2. Curing compound

II. Procedure

  A. Place concrete at starting point (Figure 1)

  (NOTE: Start pour at low section and rod uphill.)

FIGURE 1



Hyperbolic Paraboloid Umbrella Type

JOB SHEET #1

B. Use straightedge with sawlike motion and rod concrete

(CAUTION: Screeds should be set fairly close together so that grades and shape will not be deformed. Be sure there is enough concrete behind straightedge to fill holes.)

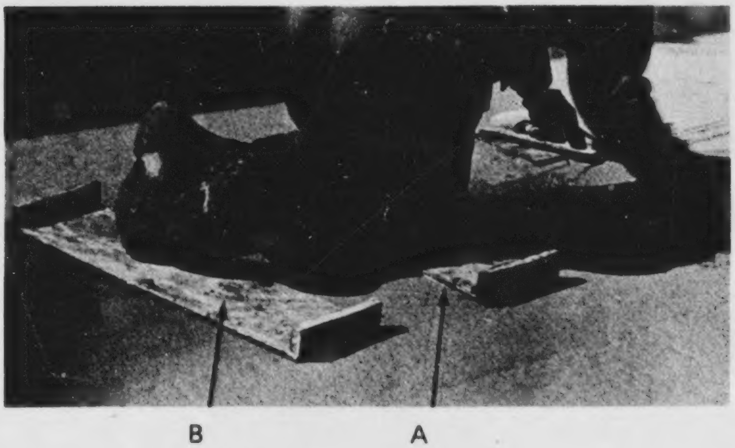
C. Use darby and float surface in an upward movement until surface is relatively smooth

(CAUTION: Occasionally, a time period needs to elapse after darbying to allow concrete to harden before continuing finishing procedures.)

(NOTE: On this type of pour a very low slump concrete will be used.)

D. Place knee boards on concrete and position body so that both knees are on knee board A with toes positioned on knee board B (Figure 2)

FIGURE 2



E. Obtain balance on knee boards by leaning on float in left hand and reaching out at arm's length with right hand; float surface in a semicircular motion, keeping float relatively flat to surface

JOB SHEET #1

F. Move backwards across slab by placing knees on knee board B and by picking up knee board A and placing it behind knee board B (Figure 3)

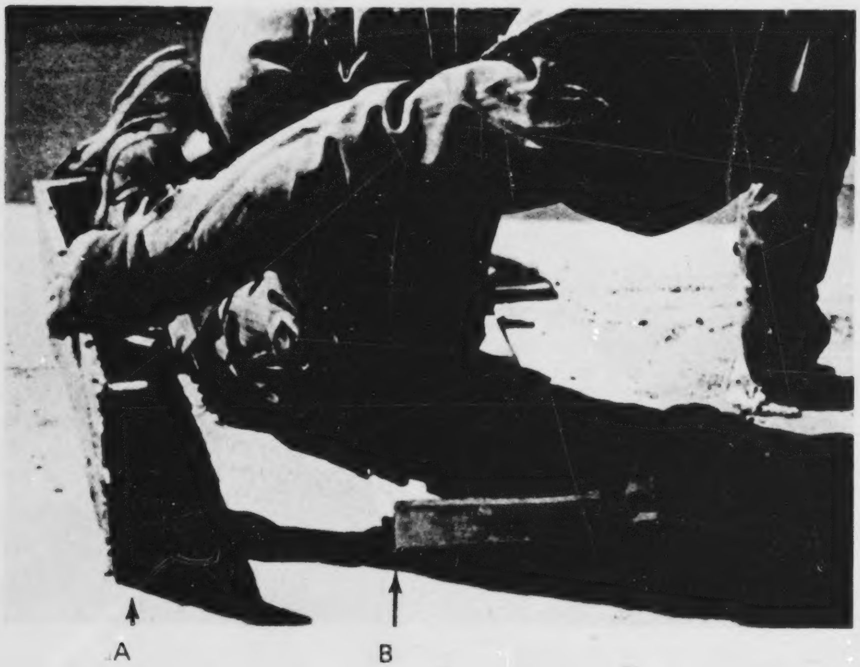


FIGURE 3

G. Continue floating and moving backwards over slab until slab is finished

H. Use sprayer with nozzle adjusted to a fine spray to apply curing compound

I. Use margin trowel to clean tools and equipment

(NOTE: On roof slabs the grade and shape is usually much more important than the finish.)

FINISHING CONCRETE ROOFS
UNIT III

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Process of compressing concrete by stretching steel wires or cables through the concrete member by methods of post-tensioning and pretensioning

______b. Process of stressing concrete member after it is placed and hardened by stretching steel cables through ducts in concrete

______c. Process of stretching steel wire through concrete and releasing it after concrete hardens to transmit compressive stress to the concrete

______d. Process of leveling high spots and/or ridges left by straightedge

______e. Stiff concrete

______f. Process of leveling out surface of concrete by cutting off high spots and filling low places

______g. Tool used to kneel on while finishing concrete

______h. Very thin poured slab usually about two and one half inches thick

______i. Concrete cast in forms either at job site or plant, cured, and then hoisted in place

______j. Rolled type roofs, such as on aircraft hangers

______k. Continuous mass of concrete cast as a single unit

______l. Shape of double curvature with surface curved on two planes

1. Thin shell
2. Hyperbolic paraboloid
3. Lightweight concrete
4. Monolithic
5. Barrel shells
6. Folded plate
7. Reinforcing
8. Precast
9. Darbying
10. Prestressed concrete
11. Floating
12. Post-tensioning
13. Knee boards
14. Pretensioning
15. Low slump
16. Darby

_____m. Steel bars or welded wire fabric positioned in concrete to increase the tensile strength of concrete

_____n. Roof shaped like a V, Z, or modified W

_____o. Concrete made either by using gas-generating chemicals or by using lightweight aggregate which will weigh 15 to 130 pounds per cubic foot

_____p. Tool used to level high spots and/or ridges left by straightedge

2. Match the types of roofs on the right to the correct methods of construction. Place the correct numbers in blanks provided.

_____a. Poured in place in very thin sections

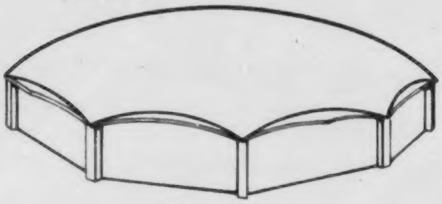
_____b. Placed, rodded, and finished directly in place over beams and/or trusses

_____c. Cast at factory and/or on job using steel wires stretched in the concrete to compress concrete and support load

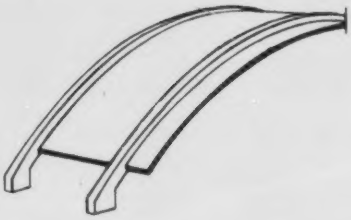
_____d. Prepared on ground or in plant and raised into position

1. Prestressed
2. Precast monolithic
3. Thin shell
4. Reinforced cast-in-place

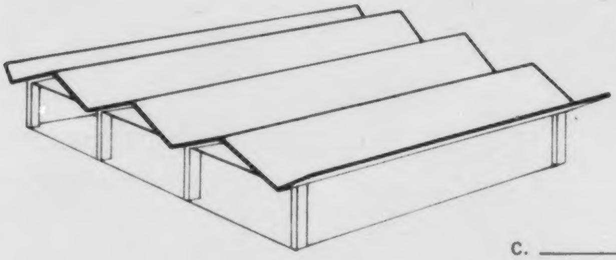
3. Identify the types of thin shell roofs by writing the correct names in the blanks provided.



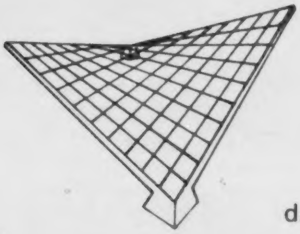
a. ______________________________



b. ______________________________

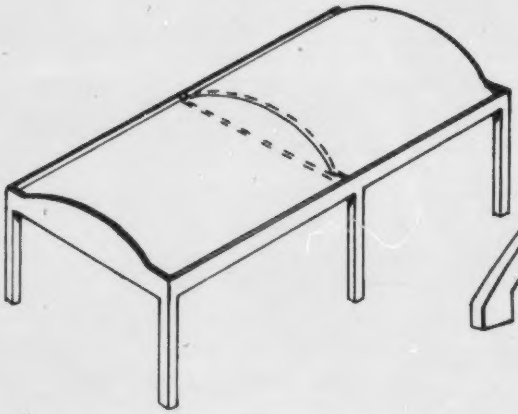


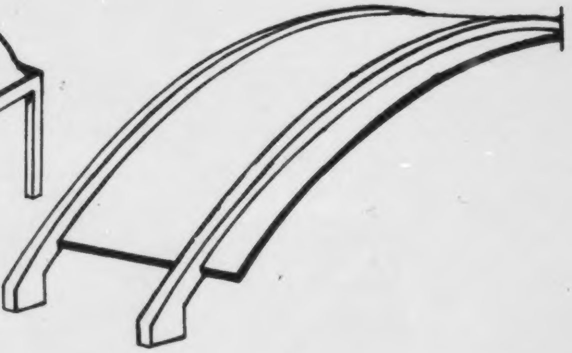
c. ______________________________



d. ______________________

4. Distinguish between short barrel and long barrel shell construction. Place an "X" by the drawing that represents the short barrel shell construction.

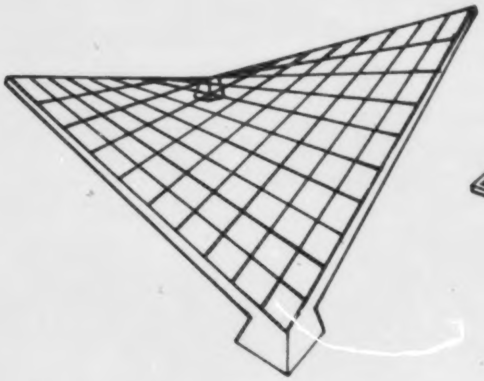


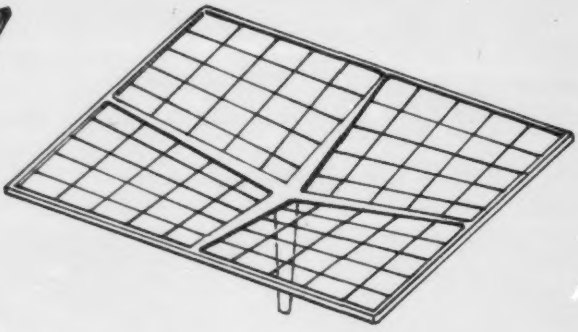


b. ______________

a. ______________

5. Identify the following types of hyperbolic paraboloid roofs by writing the appropriate names in the blanks provided.





a. ______________________

b. ______________________

6. Name three types of folded plate roofs.

   a.

   b.

   c.

7. Discuss in a few words what is meant by a dome shell.

8. Name two methods of concrete stressing.

   a.

   b.

9. Name the benefits of using types of thin shell roofs.

   a.

   b.

   c.

   d.

10. Select from the list below types of lightweight concrete used on roofs. Place an "X" in the correct blanks.

    ______a. Air-entrained

    ______b. Semi-lightweight

    ______c. Colored concrete

    ______d. Insulating

    ______e. Low slump concrete

    ______f. Structural ligthweight

11. Select from the following list four factors to consider when pouring a roof slab. Circle the correct letters.

    a. Correct grade or elevation

    b. Slump

    c. Price

    d. Correct mix

    e. Type of roof

    f. Variation in thickness to allow adequate drainage

12. Demonstrate the ability to place and finish a reinforced cast-in-place umbrella type roof.

    (NOTE: If the above activity has not been accomplished prior to test, ask your instructor when it should be completed.)

FINISHING CONCRETE ROOFS
UNIT III

ANSWERS TO TEST

1. a. 10
   b. 12
   c. 14
   d. 9
   e. 15
   f. 11
   g. 13
   h. 1
   i. 8
   j. 5
   k. 4
   l. 2
   m. 7
   n. 6
   o. 3
   p. 16
2. a. 3
   b. 4
   c. 1
   d. 2
3. a. Dome
   b. Barrel
   c. Folded plate
   d. Hyperbolic paraboloid
4. b
5. a. Saddle type
   b. Umbrella type
6. a. V-shaped
   b. W-shaped
   c. Z-shaped
7. Portion of a sphere that is symmetrical and spacious
8. a. Post-tension
   b. Pretension
9. a. Saves material
   b. Reduces reinforcement

  - c. Reduces size of supporting columns
  - d. Reduces form cost

10. b, d, f
11. a, b, d, f
12. Performance skill evaluated to the satisfaction of the instructor

FINISHING CONCRETE STEPS
UNIT IV

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify types of step construction, nosings used on steps, and types of finishes for step treads. He should be able to demonstrate the ability to pour and finish steps. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with finishing concrete steps to the proper definitions.
2. Identify types of step construction.
3. Identify the types of finishes for step treads.
4. Identify where to start the first pour on a set of steps.
5. Identify types of nosings used on steps.
6. Name two reasons for using low slump concrete on steps.
7. Demonstrate the ability to:
    a. Set forms for steps on solid fill.
    b. Set forms for short set of steps.
    c. Pour and finish steps with fine swirl finish.
    d. Pour and finish pan steps with nonskid finish.
    e. Pour and finish steps with manufactured nosings and pipe inserts.

FINISHING CONCRETE STEPS
UNIT IV

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information sheet.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Types of Steps

    2. TM 2--Types of Steps (Continued)

    3. TM 3--Types of Step Nosings

D. Job sheets

1. Job Sheet #1--Set Forms for Steps on Solid Fill
2. Job Sheet #2--Set Forms for Short Set of Steps
3. Job Sheet #3--Pour and Finish Steps with Fine Swirl Finish
4. Job Sheet #4--Pour and Finish Pan Steps with Nonskid Finish
5. Job Sheet #5--Pour and Finish Steps with Manufactured Nosings and Pipe Inserts

II. References:

A. *Cement Mason's Guide to Building Concrete Walks, Drives, Patios, and Steps.* Skokie, Illinois: Portland Cement Association, 1971.

B. *Suggested Unit Course in Concrete Form Construction: Carpentry Series.* Albany, New York: Delmar Publishers.

FINISHING CONCRETE STEPS
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Pan steps--Prefabricated step forms

B. Precast--Concrete prepared on ground or at plant and moved and set into position

C. Manufactured nosing--Substance molded or manufactured of cast iron or aluminum and abrasive material

D. Low slump--Stiff concrete

E. Layed down--Phrase used for the first floating of concrete

F. Fall--Amount of slope from rear to front edge of step

G. Mud--Mixture of sand, cement, and water

H. Abrasive grit--Particle composed of aluminum oxide or silicon carbide

I. Aluminum oxide--Very hard, abrasive grains

J. Silicon carbide--Very hard, irridescent, abrasive compound

K. Pipe insert--Round pipe of various lengths with anchors attached; inserted into concrete

L. Flush--Even with

M. Puddle--Vibrate and/or work concrete to eliminate honeycomb and to produce a denser mass

N. Honeycomb--Cavity or pit in concrete

O. Safety step edger--Special type of combination edger/jointer which usually has four bits

P. Framing square gauge--Device attached to a framing square to secure accuracy when laying out material

Q. Riser--Vertical part of a stair step

R. Tread--Horizontal part of a stair step

S. Allthread--Round piece of metal with threads the full length

INFORMATION SHEET

T. Form oil--Manufactured product used on forms to prevent adhesion of the concrete to the form

U. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete

II. Types of step construction (Transparencies 1 and 2)

A. Solid fill base

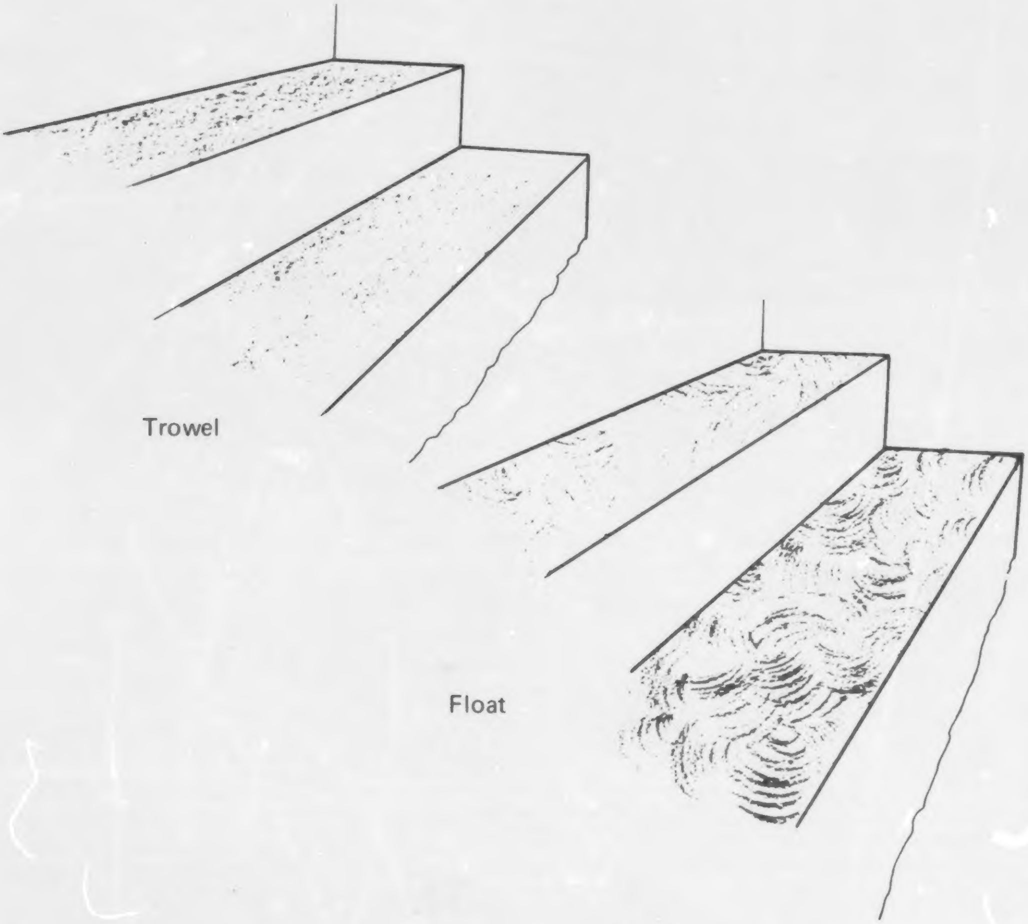
B. Open

C. Open metal pan

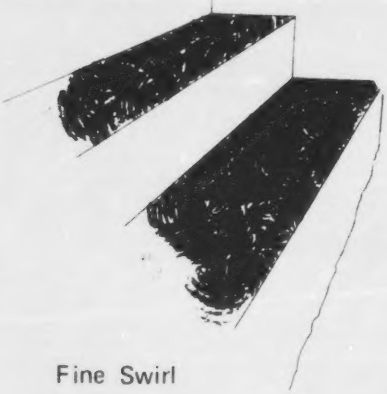
D. Closed metal pan

E. Precast

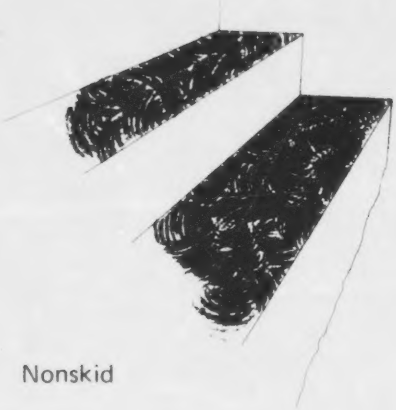
III. Types of finishes for step treads



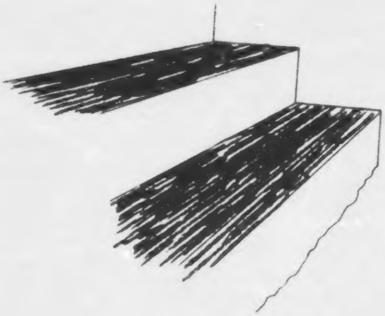
INFORMATION SHEET



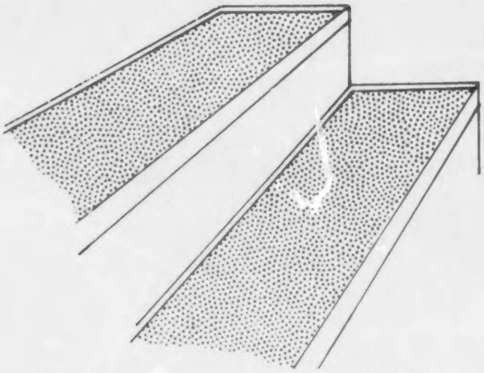
Fine Swirl



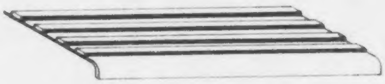
Nonskid



Brush



Trowel Finish Holding Down 1/8" for Tile

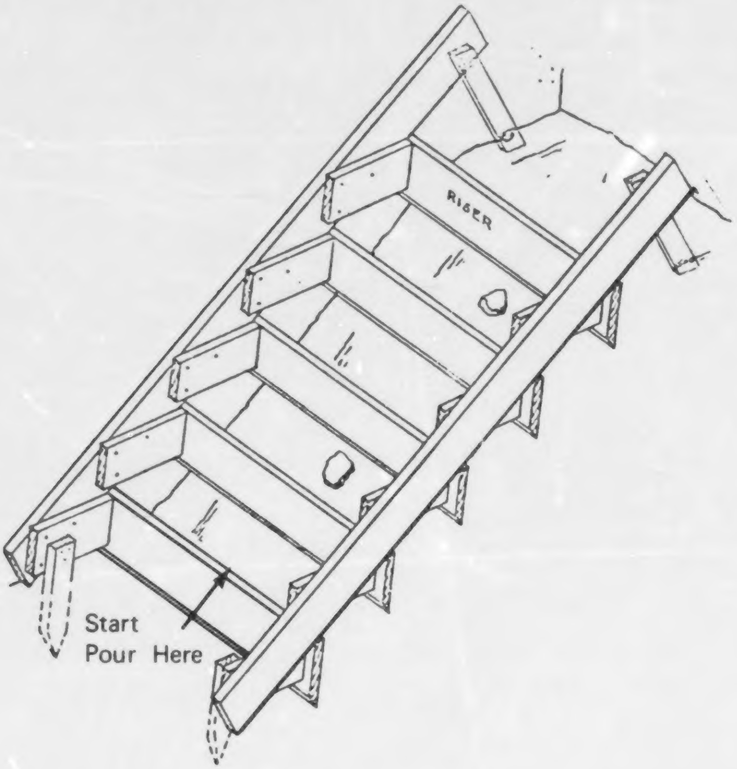


Manufactured Nosings

INFORMATION SHEET

IV. Where to start the first pour--At the bottom of a set of steps

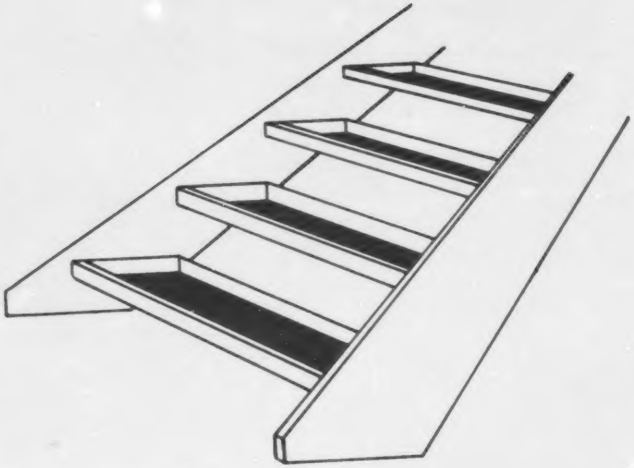
(NOTE: Exception will be made only when pouring pan type steps since just the tread is being filled.)



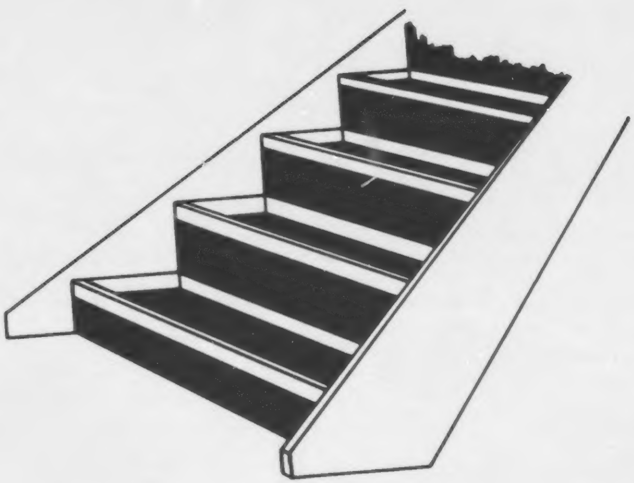
V. Types of nosings (Transparency 3)
- A. Small plain nosing
- B. Aluminum nosing
- C. Cast iron nosing
- D. Abrasive strips
- E. Nosing created with safety edger

VI. Reasons for using low slump concrete on steps
- A. To prevent concrete from slumping into lower steps
- B. To set faster

Types of Steps



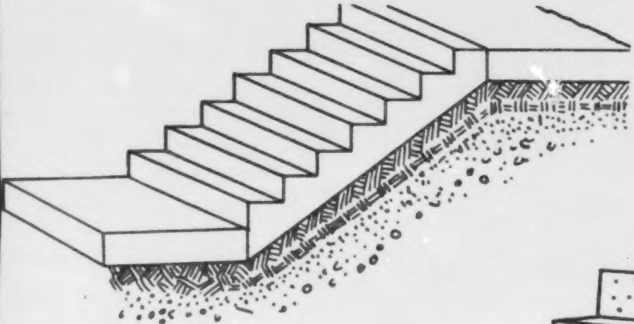
Open Metal Pan



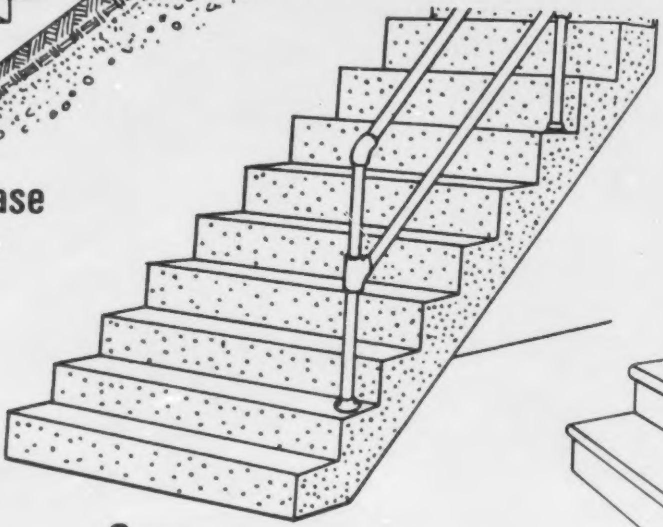
Closed Metal Pan

Types of Steps

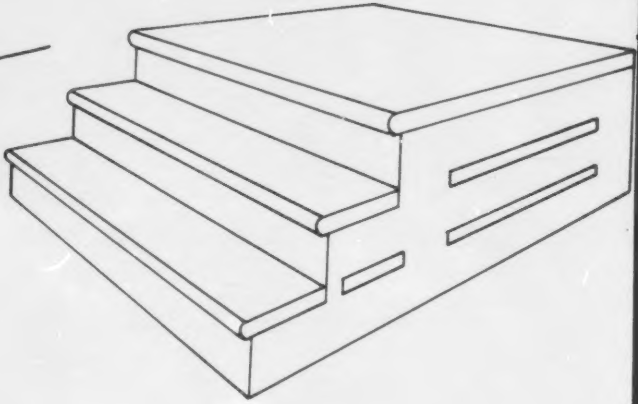
(Continued)



Solid Fill Base



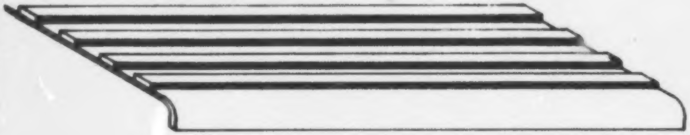
Open

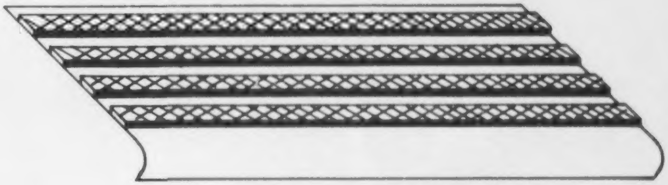


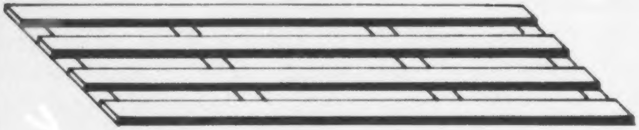
Precast

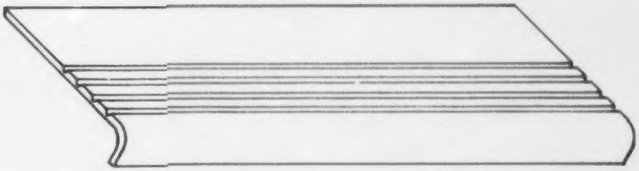
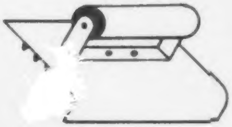
Types of Step Nosings

Small Plain Nosing


Aluminum Nosing


Cast Iron Nosing


Abrasive Strips



Nosing Created with
Safety Edger

FINISHING CONCRETE STEPS
UNIT IV

JOB SHEET #1--SET FORMS FOR STEPS ON SOLID FILL

I. Tools and materials

A. Tools

1. Hammer (16 oz. or larger)
2. Handsaw (crosscut)
3. Electric handsaw
4. Sledge hammer
5. Framing square gauges
6. Level (hand)
7. Builder's level
8. Framing square
9. Tape measure, 12' or 16'

B. Materials

1. Side forms, plywood
2. Stakes, 2 x 4's
3. Aligners, 2 x 4's
4. Risers, 2 x 8's
5. Blocks, 2 x 4's
6. Braces, 1 x 4's

II. Procedure

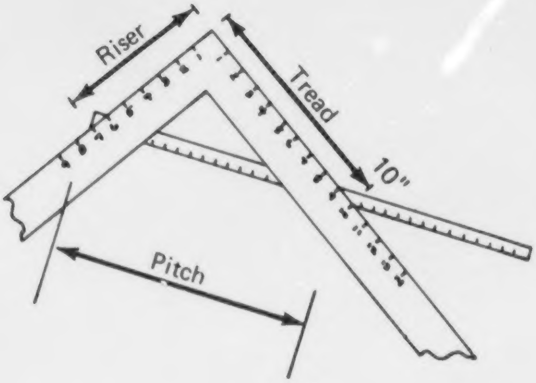
A. Determine width and length of side form (Figure 1)

1. Form width will be the slab thickness plus the riser height and two inches

JOB SHEET #1

2. Form length will be the length on the pitch of one step times the number of steps in the flight; add one foot for overhang

FIGURE 1

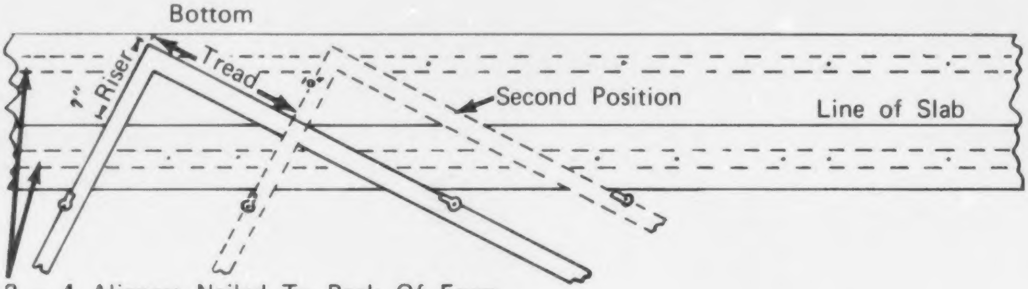

Riser
Tread
10"
Pitch

B. Cut form side to size

(NOTE: Form sides may also be made from 1 x 6's or wider boards cleated together.)

C. Lay out side forms (Figure 2)

FIGURE 2


Bottom
7"
Riser
Tread
Second Position
Line of Slab

2 x 4 Aligners Nailed To Back Of Form

JOB SHEET #1

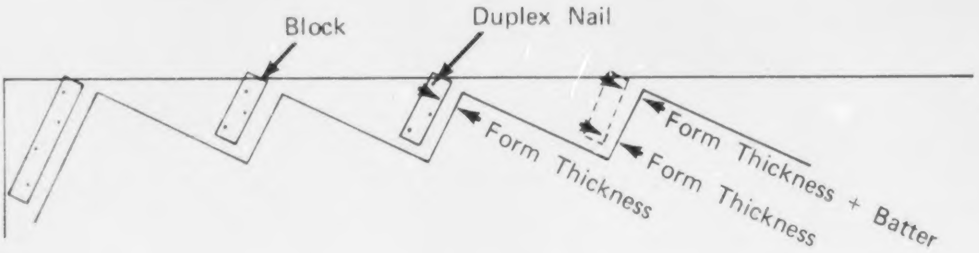
1. Gauge a line equal to the slab thickness on the form side
2. Lay framing square on form with riser height and tread width on slab line
3. Attach framing square gauges
4. Mark tread and riser on form
5. Move square to next step and lay out tread and riser

   (NOTE: Use a sharp pencil and follow line intersections accurately.)
6. Repeat step 5 to complete layout
7. Lay out opposite side form following steps 1 to 6 inclusive

   (NOTE: There will be two form sides. The forms will be laid out for right and left hand sides.)
8. Nail aligners to form sides

D. Nail riser support blocks to form sides (Figure 3)

FIGURE 3



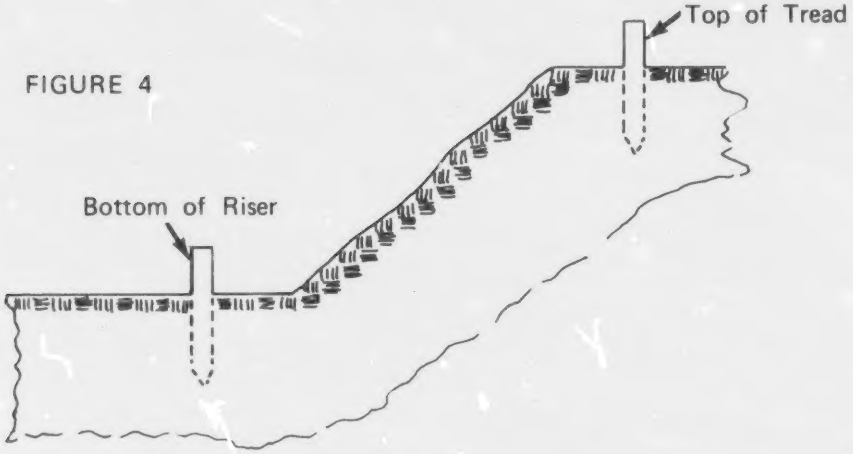
(NOTE: For battered riser, add batter dimension to tread length as shown on right hand riser.)

JOB SHEET #1

E. Set grade stakes at top and bottom of flight (Figure 4)

(NOTE: Use builder's level to establish grade from bench mark.)

FIGURE 4



F. Drive side form support stakes

(NOTE: Allow for sheathing and aligners when driving stakes.)

G. Set form sides

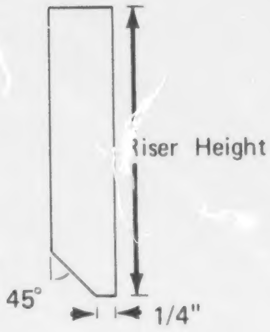
1. Set form side against stakes
2. Level over from bottom grade stake to bottom of first riser; adjust form and nail to stake
3. Level over from top grade stake to top tread line; adjust form and nail to stake
4. Nail form to intermediate stakes
5. Repeat steps 1 to [illegible] inclusive to continue erection

JOB SHEET #1

H. Size riser forms (Figure 5)

1. Cut form material to length
2. Cut riser forms to width
3. Cut bottom of riser form to 45° angle

FIGURE 5



I. Install riser forms

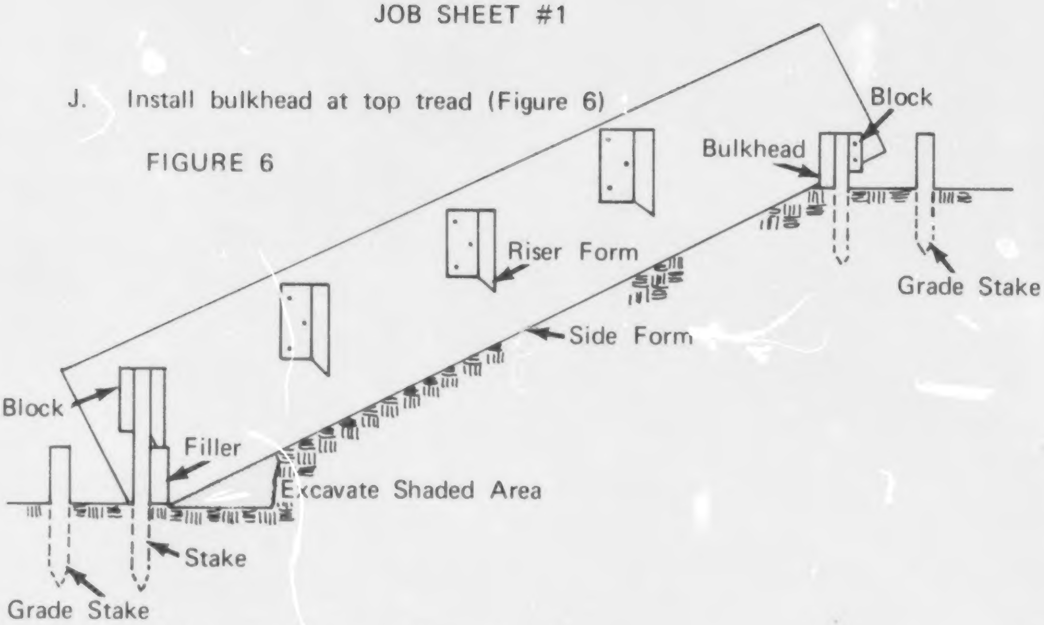
1. Place riser form in position with top of form flush with tread line and against block
2. Nail riser forms from back side of side form using duplex nails
3. Repeat steps 1 and 2 to continue installation

   (NOTE: If bottom landing slab is not poured at this time, a filler piece the thickness of the slab will have to be installed under the bottom riser form.)

JOB SHEET #1

J. Install bulkhead at top tread (Figure 6)

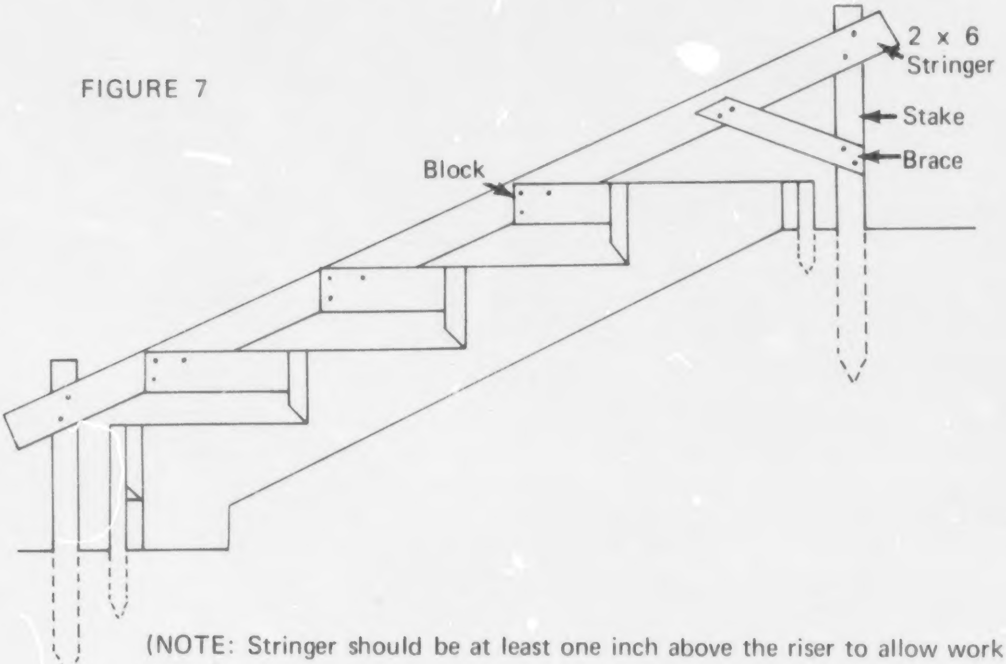
FIGURE 6


Block
Bulkhead
Riser Form
Grade Stake
Side Form
Block
Filler
Excavate Shaded Area
Stake
Grade Stake

K. Install center support (Figure 7)

(NOTE: Center supports are not needed on narrow flights of stairs.)

FIGURE 7


2 x 6
Stringer
Stake
Brace
Block

(NOTE: Stringer should be at least one inch above the riser to allow work room.)

L. Apply form oil to forms when setting is complete

FINISHING CONCRETE STEPS
UNIT IV

JOB SHEET #2--SET FORMS FOR SHORT SET OF STEPS

I. Tools and materials

A. Tools

1. Hammer (16 oz. or larger)
2. Handsaw (crosscut)
3. Electric handsaw
4. Sledge hammer
5. Framing square gauges
6. Framing square
7. Level (hand)
8. Electric drill and bits

B. Materials

1. Side forms, plywood
2. Stakes and stiffener, 2 x 4's
3. Risers, 2 x 8's
4. Braces, 1 x 4's
5. Spreaders, 1/2" conduit
6. Ties, allthread or smooth rod

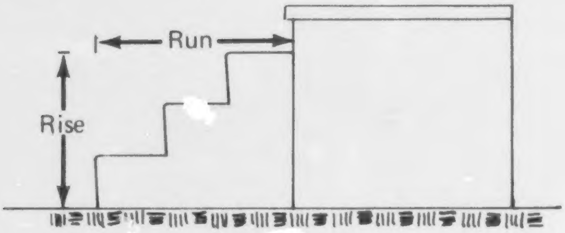
II. Procedure

A. Determine width and length of side form (Figure 1)

JOB SHEET #2

(NOTE: Forms should be at least 4" wider than rise and run.)

FIGURE 1

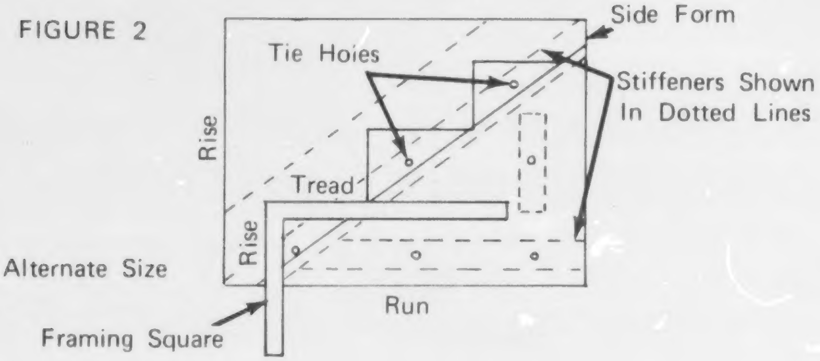


B. Cut forms to size

C. Lay out steps on both forms (Figure 2)

(NOTE: Make a right and left hand layout.)

FIGURE 2


Side Form
Tie Holes
Stiffeners Shown In Dotted Lines
Rise
Tread
Rise
Alternate Size
Run
Framing Square

D. Drill tie holes in pattern shown in Figure 2

(NOTE: Place forms back to back and drill at the same time.)

E. Attach stiffeners to back side of forms centered on tie holes and drill tie holes in stiffeners

F. Cut spreaders and ties to length

1. Spreaders shall be as long as the stair is wide

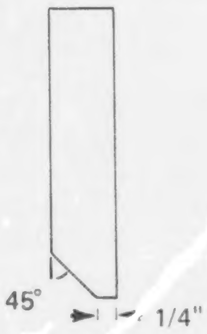
2. Cut threaded rod (allthread) the width of the stairs plus two form thicknesses and lengths for nuts and washers on each end

(NOTE: Add one inch for tie projection.)

JOB SHEET #2

G. Size riser froms (Figure 3)

FIGURE 3



1. Lay out batter of riser on side form to determine exact width

2. Cut riser form to width

3. Cut riser form to length

   (NOTE: Riser form length will be the same as the stair width.)

4. Cut 45° angle on face of tread

   (NOTE: See Figure 3.)

H. Assemble side forms

1. Stand side forms on level surface

2. Place ties through spacer and holes in both forms and secure with nut and washer

   (NOTE: One nut and washer should be placed on the allthread rod before it is installed.)

3. Snug up nuts to hold forms together

I. Set form in pour location

(NOTE: Check for level across top of riser form and plumb side forms.)

1. Drive stakes at outside of form sides

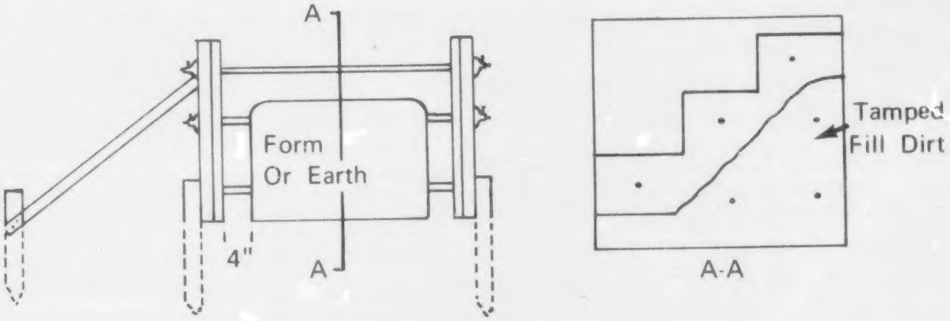
2. Raise to level position both directions and nail to stakes

JOB SHEET #2

J. Place fill dirt or form under slab (Figure 4)

(NOTE: If a form is used, it should be set before the side forms are set. Steps should be doweled at the top and rest on a footing.)

FIGURE 4



K. Place brace as shown in Figure 4

(NOTE: Very little bracing is needed on this type of form. This type of form may be used in many situations.)

L. Apply form oil to forms when setting is complete

FINISHING CONCRETE STEPS
UNIT IV

JOB SHEET #3–POUR AND FINISH STEPS WITH FINE SWIRL FINISH

I. Tools and materials

A. Tools

1. Hand float
2. Hand trowel
3. Midget trowel
4. Margin trowel
5. Edger and step edger
6. Step tools
7. Small level (torpedo)
8. Cork or rubber float
9. Brush
10. Claw hammer
11. Knee pads
12. Knee boards
13. Sprayer

B. Materials

1. Concrete
2. Mud
3. Bucket of water
4. Curing agent

JOB SHEET #3

II. Procedure

A. Start pour at bottom step

(CAUTION: Be sure each step is well vibrated but do not over vibrate because this would force concrete down into lower steps.)

B. Use margin trowel to spade along inside edge of forms to insure that face is properly filled

C. Float surface of first step until it is relatively smooth and on grade

(NOTE: All excess concrete should be placed in step above.)

D. Continue filling and floating steps, working upward until all steps have been filled and layed down

(NOTE: It may be necessary for a time period to elapse before proceding to next step.)

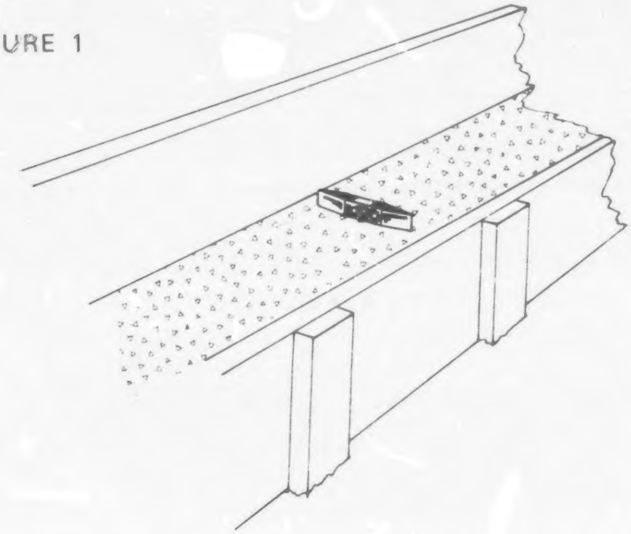
E. Place knee boards on steps three and four from top if concrete is hard enough

F. Kneel on top board to balance self and float top step until it is relatively smooth and to grade

G. Use level to check step to insure that it has proper fall (Figure 1)

(NOTE: Steps should have at least one quarter inch fall.)

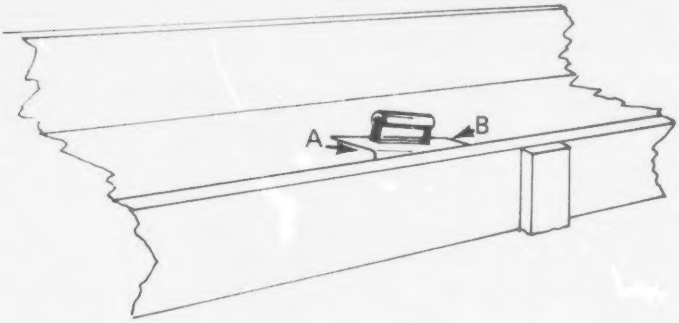
FIGURE 1



JOB SHEET #3

H. Tilt point A of edger slightly up and move edger forward along inside of form; then with point B tilted up move edger backward until edge is rounded and smooth (Figure 2)

FIGURE 2



I. Hold trowel relatively flat to surface and trowel top step

(NOTE: Sometimes forms are built so that it is hard to trowel corners. If this is so, use pipe trowel or margin trowel to work out the corners.)

J. Move knee boards down one step and continue same procedure on second step

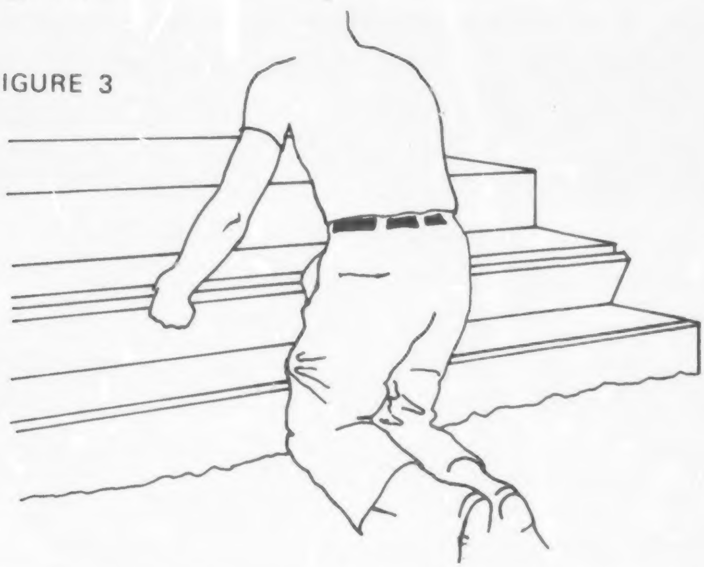
K. Continue these procedures until all steps have been troweled a first time

(NOTE: If landings are poured with steps, follow same floating and troweling procedures as you move down flight of steps. It may be necessary for a time period to elapse before starting to remove riser boards.)

JOB SHEET #3

L. Use claw hammer to pull nails from top riser board and remove board (Figure 3)

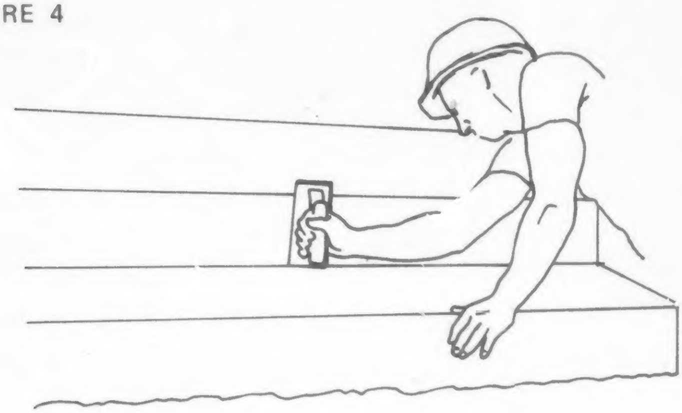
FIGURE 3



M. Dampen face of riser slightly with wet brush when necessary

N. Use cork or rubber float and a little mud that has been prepared to float in a circular motion, just enough so that riser will be smooth (Figure 4)

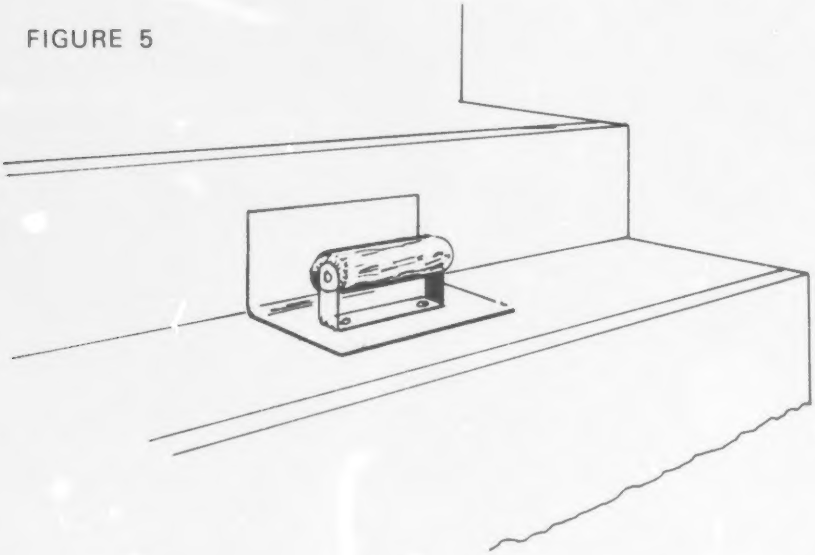
FIGURE 4



JOB SHEET #3

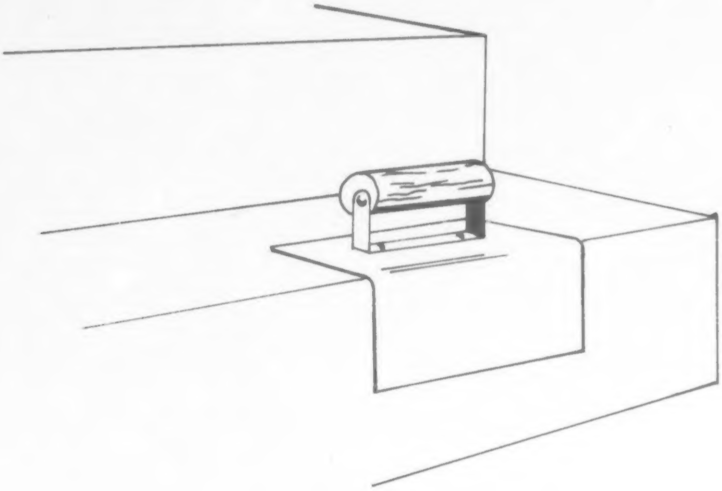
O. Use inside step tool and move tool back and forth along cove until smooth (Figure 5)

FIGURE 5



P. Use outside step tool in a back and forth motion to smooth top edge of riser (Figure 6)

FIGURE 6



JOB SHEET #3

Q. Use midget trowel to trowel face of riser in a back and forth motion until surface is smooth

R. Use damp brush to brush face of riser very lightly back and forth to obtain a fine textured finish

S. Move trowel in a semicircular fanlike motion, keeping trowel flat to surface

(NOTE: This will leave a fine, fuzzy, fanlike pattern.)

T. Move knee boards down one step and continue same procedure until steps have been completed

U. Apply curing agent using sprayer with nozzle adjusted to a fine mist

V. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE STEPS
UNIT IV

JOB SHEET #4--POUR AND FINISH PAN STEPS WITH NONSKID FINISH

I. Tools and materials

  A. Tools

    1. Hand float
    2. Hand trowel
    3. Margin trowel
    4. Small level (torpedo)
    5. Knee boards
    6. Knee pads
    7. Brush
    8. Sprayer

  B. Materials

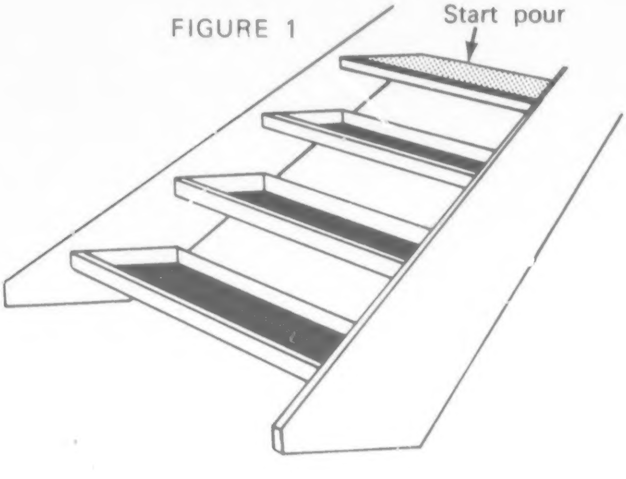
    1. Concrete
    2. Abrasive grits
    3. Bucket of water
    4. Curing agent

II. Procedure

  A. Start pour at top step (Figure 1)

  (CAUTION: Concrete in most pan steps is 2-2 1/2" thick. Therefore, caution should be taken to compact and work the concrete properly.)

FIGURE 1



JOB SHEET #4

B. Float surface of top step until it is relatively smooth and on grade

(NOTE: All excess concrete will be moved down to next step.)

C. Move down and continue filling and floating steps until all have been filled and layed down

(NOTE: It may be necessary for a time period to elapse before proceeding with next step.)

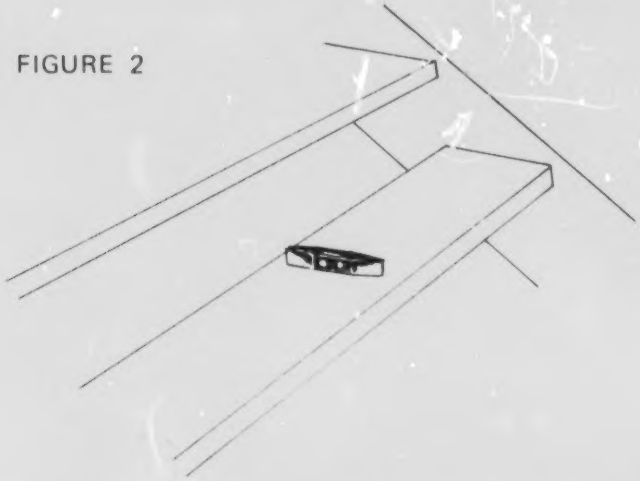
D. Place knee boards on steps three and four from top, if concrete is hard enough

E. Kneel on top board to balance self and float top step until it is relatively smooth and to grade

F. Use level to check step to insure that it has proper fall (Figure 2)

(NOTE: Steps should have at least one quarter inch fall.)

FIGURE 2



G. Hold trowel relatively flat to surface and trowel top step

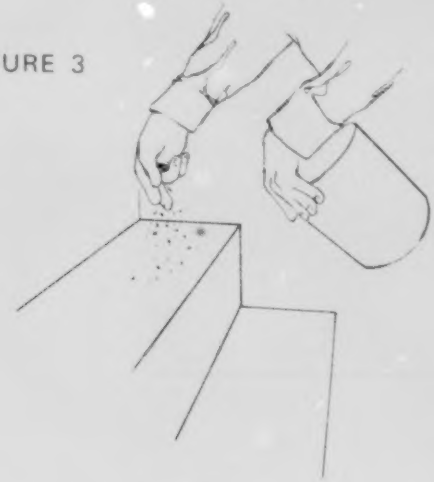
H. Move knee boards down one step and continue same procedure until all steps have been troweled first time

(NOTE: If landings are poured with steps, follow same floating and troweling procedures as you move down flight of steps. It may be necessary for a time period to elapse before starting next steps.)

JOB SHEET #4

I. Use hands to sprinkle abrasive grits evenly over surface of steps, providing concrete is hard enough (Figure 3)

FIGURE 3



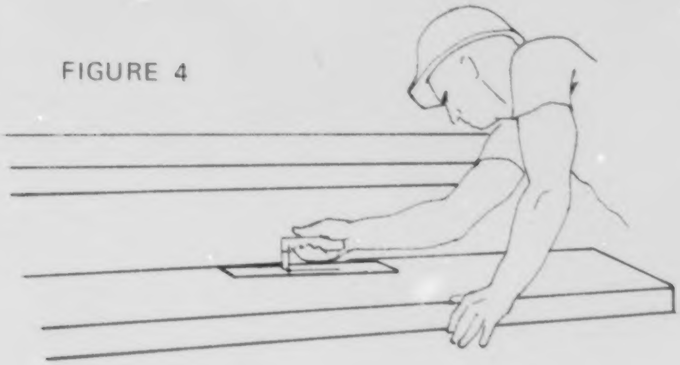
J. Place knee boards on steps three and four and again trowel steps, working grits into surface

(NOTE: Do not overwork. Grits should be worked just barely into surface to create a nonskid finish.)

K. Trowel surface in a semicircular fanlike motion, keeping trowel flat to surface to obtain desired finish (Figure 4)

(NOTE: This will leave a fine, fuzzy, fanlike pattern.)

FIGURE 4



JOB SHEET #4

L. Move knee boards down one step and continue same procedure until steps have been completed

M. Apply curing agent using sprayer with nozzle adjusted to a fine mist

N. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE STEPS
UNIT IV

JOB SHEET #5--POUR AND FINISH STEPS WITH MANUFACTURED NOSINGS AND PIPE INSERTS

I. Tools and materials

   A. Tools

      1. Float
      2. Trowel
      3. Midget trowel
      4. Margin trowel
      5. Small level (torpedo)
      6. Hammer
      7. Brush
      8. Knee pads
      9. Knee boards
      10. Rule
      11. Sprayer

   B. Materials

      1. Concrete
      2. Nosings

         (NOTE: Nosings should be sprayed or covered to keep concrete from sticking to surface.)

      3. Bucket of water
      4. Pipe inserts
      5. Curing agent

JOB SHEET #5

II. Procedure

A. Start pour at bottom step

(CAUTION: Be sure each step is well vibrated but do not over vibrate. This would force concrete down into lower steps and defeat everything previously done.)

B. Use margin trowel to spade along inside edge of forms to insure that the face is properly filled

C. Float surface of first step until it is relatively smooth and on grade

(NOTE: All excess concrete should be placed on step above.)

D. Continue filling and floating steps, working upward until all steps have been filled and layed down

(NOTE: It may be necessary for a time period to elapse before proceeding with next step.)

E. Place knee boards on steps three and four from top, providing concrete is hard enough

F. Kneel on top board to balance self and float top step until it is relatively smooth and to grade

G. Use rule to lay out and mark tread so it will center on step

H. Use margin trowel to cut along front edge of form

I. Place nosing on step with front edge tight to form and, using hammer and/or block of wood, tap nosing down until it is flush with top of form

J. Use margin trowel to puddle concrete under nosing to be sure it is sealed properly and that concrete is worked around anchors

K. Lay out and mark location of pipe insert

L. Use margin trowel to dig hole in concrete at location of insert

M. Place insert in hole and tap lightly until insert is on grade in proper location

N. Work concrete around insert until it is properly seated

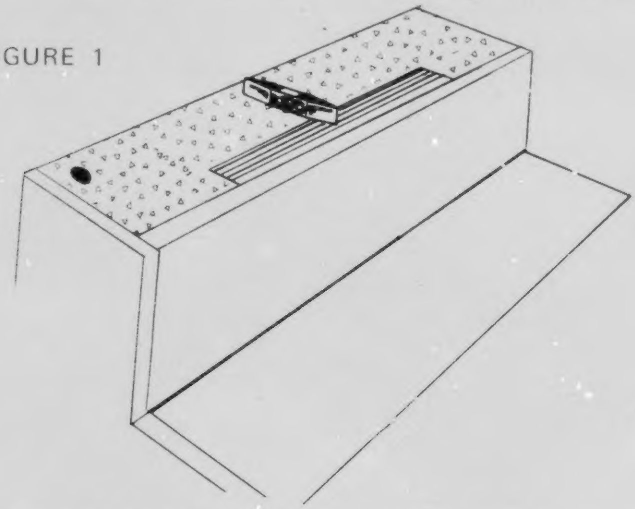
O. Float step until it is smooth and on grade

JOB SHEET #5

P. Use level to check step to insure that it has proper fall (Figure 1)

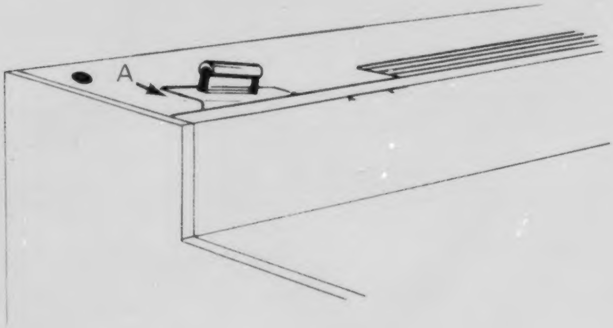
(NOTE: Steps should have at least one quarter inch fall.)

FIGURE 1



Q. Tilt point A of edger slightly up and edge remaining section of step (Figure 2)

FIGURE 2



R. Hold trowel relatively flat to surface and trowel top step

(NOTE: Sometimes forms are built so that it is hard to trowel corners; if this is so, use pipe trowel or margin trowel to work out the corners.)

JOB SHEET #5

S. Move knee boards down one step and continue same procedure on second step

(NOTE: Inserts will not be used on every step. Therefore, repeat this step only when necessary.)

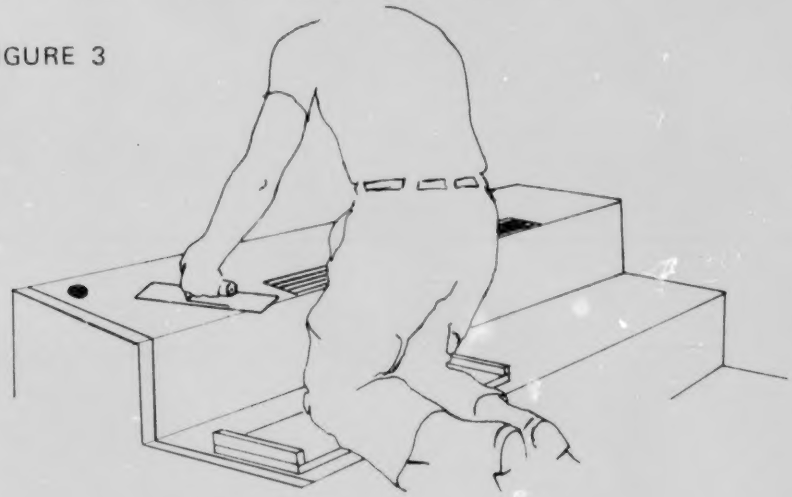
T. Continue procedures until all nosings are in and steps have been troweled first time

(NOTE: If landings are poured with steps, follow same floating and troweling procedures as you move down flight of stairs.)

U. Start at top step and repeat troweling procedures, this time moving trowel in a semicircular fanlike motion and keeping trowel flat to surface (Figure 3)

(NOTE: This will leave a fine, fuzzy, fanlike pattern.)

FIGURE 3



V. Continue this procedure until steps are completed

W. Apply curing agent using sprayer with nozzle adjusted to a fine mist

X. Use margin trowel, brush, and water to clean tools and equipment

(NOTE: To keep from loosening nosings, riser forms will not be removed at this time. They will be removed after concrete has hardened. Risers will be rubbed and finished.)

FINISHING CONCRETE STEPS
UNIT IV

TEST

1. Match terms on the right to the correct definitions on the left. Place the appropriate numbers in the blanks provided.

______a. Prefabricated step forms

______b. Cavity or pit in concrete

______c. Concrete prepared on ground or at plant and moved and set into position

______d. Vibrate and/or work concrete to eliminate honeycomb and to produce denser mass

______e. Substance molded or manufactured of cast iron or aluminum and abrasive material

______f. Even with

______g. Stiff concrete

______h. Phrase used for first floating of concrete

______i. Round pipe of various lengths with anchors attached; inserted into concrete

______j. Very hard, irridescent, abrasive compound

______k. Amount of slope from rear to front edge of step

______l. Very hard, abrasive grains

______m. Particle composed of aluminum oxide or silicon carbide

______n. Mixture of sand, cement, and water

______o. Special type of combination edger/jointer which usually has four bits

______p. Device attached to a framing square to secure accuracy when laying out material

1. Honeycomb
2. Flush
3. Silicon carbide
4. Abrasive grit
5. Aluminum oxide
6. Puddle
7. Mud
8. Pipe insert
9. Pan steps
10. Fall
11. Manufactured nosing
12. Layed down
13. Precast
14. Low slump
15. Safety step edger
16. Allthread
17. Tread
18. Riser
19. Framing square gauge
20. Form oil
21. Curing agent

______q. Vertical part of a stair step

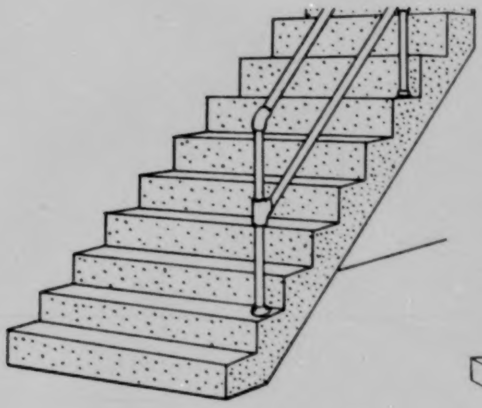
______r. Horizontal part of a stair step

______s. Round piece of metal with threads the full length

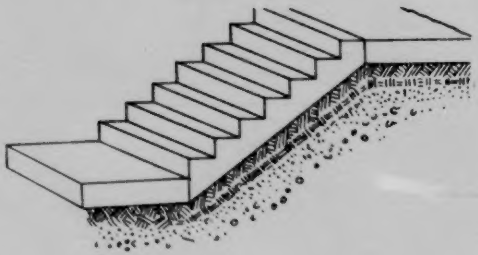
______t. Manufactured product used on forms to prevent adhesion of the concrete to the form

______u. Chemical compound used to prevent evaporation of moisture from concrete

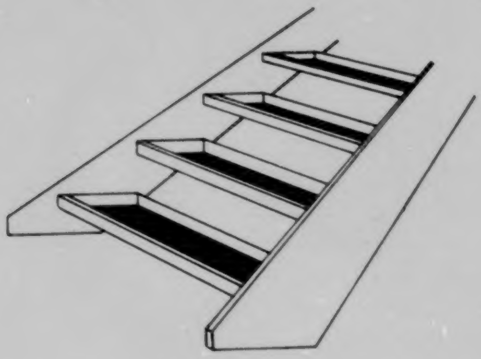
2. Identify the types of step construction illustrated below and on the following page. Place the correct names in the blanks provided.



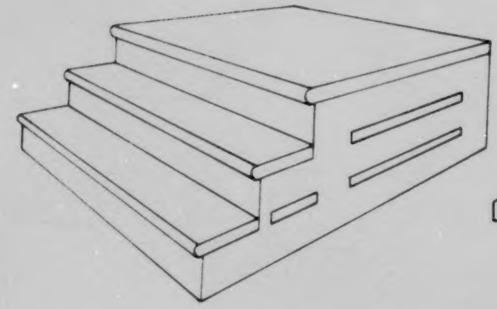
a. ______________________________



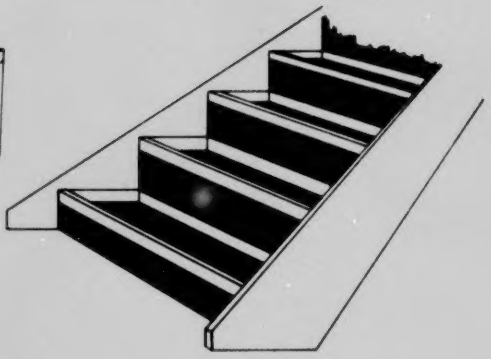
b. ______________________________



c. ______________________________

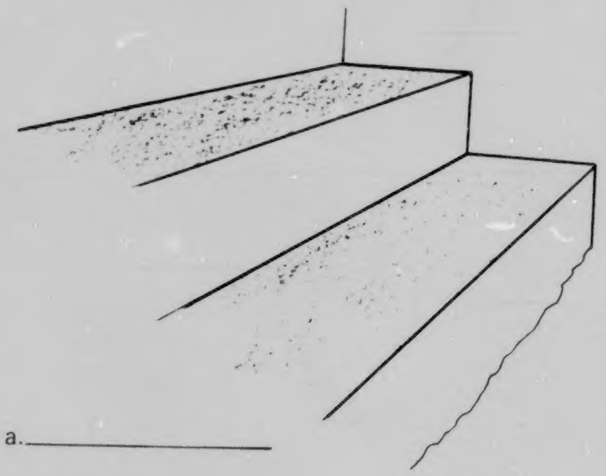


d. ____________________

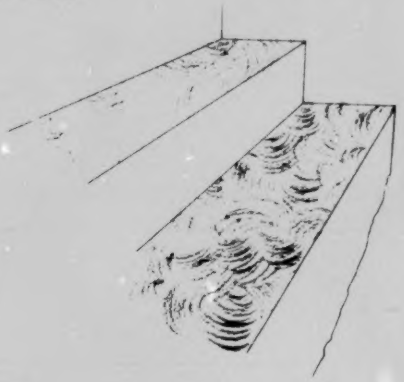


e. ____________________

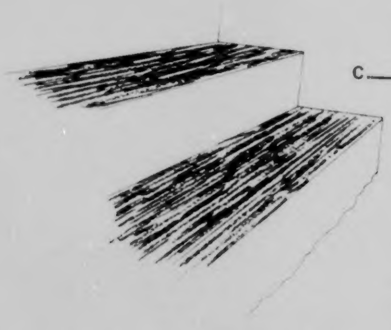
3. Identify the types of finishes for step treads below and on the following page. Write the correct names in the blanks provided.



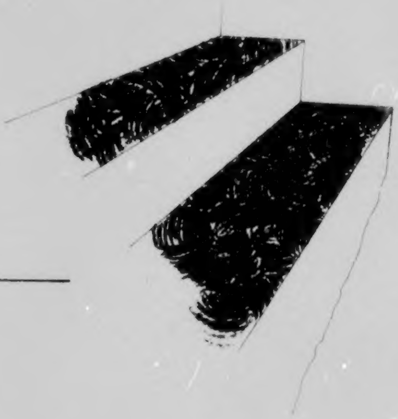
a. ____________________



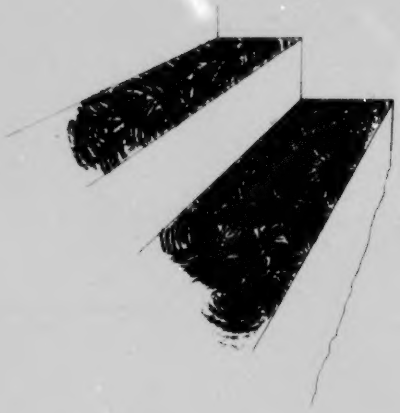
b. ____________________



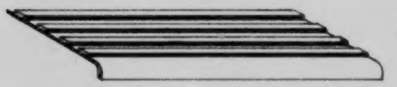
c. ____________________



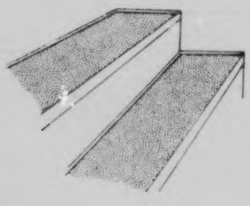
d. ____________________



e. ____________________



f. ____________________

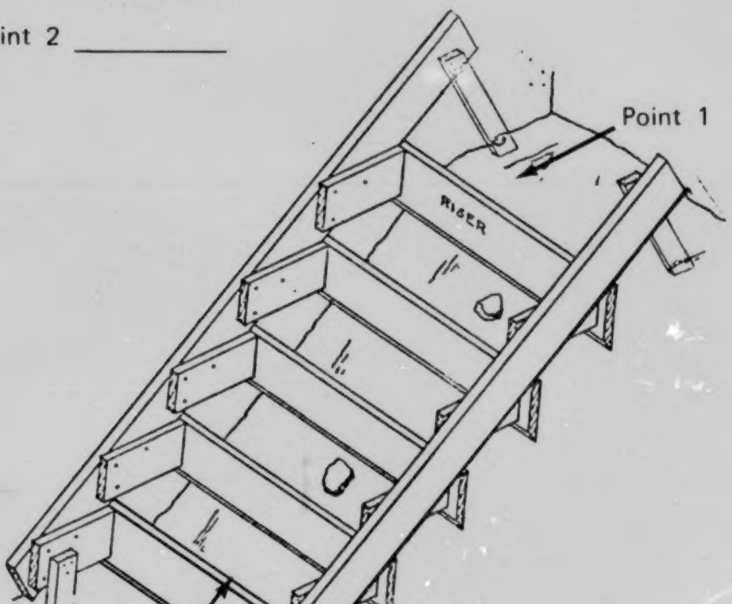


g ____________________

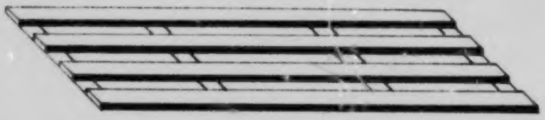
4. Identify from the illustration below where to start the first pour on a set of steps. Place an "X" in the proper blank.

   a. Point 1 __________

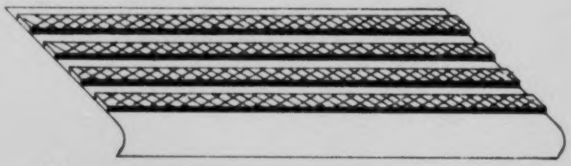
   b. Point 2 __________


Point 1
RISER
Point 2

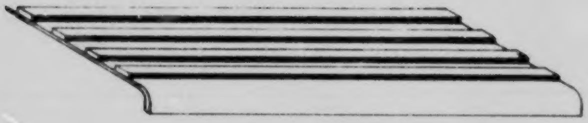
5. Identify the following types of nosings used on steps.



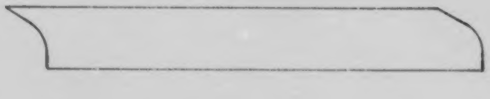
a. ______________________________



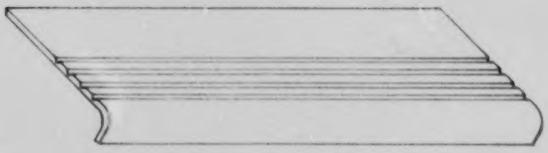
b. ______________________________



c. ______________________________



d. ______________________________



e. ______________________________

6. Name two reasons for using low slump concrete on steps.

   a.

   b.

7. Demonstrate the ability to:

   a. Set forms for steps on solid fill.

   b. Set forms for short set of steps.

   c. Pour and finish steps with fine swirl finish.

   d. Pour and finish pan steps with nonskid finish.

   e. Pour and finish steps with manufactured nosings and pipe inserts.

   (NOTE: If the above activities have not been accomplished prior to test, ask your instructor when they should be completed.)

FINISHING CONCRETE STEPS
UNIT IV

ANSWERS TO TEST

1. a. 9
   b. 1
   c. 13
   d. 6
   e. 11
   f. 2
   g. 14
   h. 12
   i. 8
   j. 3
   k. 10
   l. 5
   m. 4
   n. 7
   o. 15
   p. 19
   q. 18
   r. 17
   s. 16
   t. 20
   u. 21

2. a. Open
   b. Solid fill base
   c. Open metal pan
   d. Precast
   e. Closed metal pan

3. a. Trowel
   b. Float
   c. Brush
   d. Fine swirl or Nonskid
   e. Nonskid or Fine swirl
   f. Manufactured nosings
   g. Trowel finish holding down 1/8" for tile

4. b. Point 2

5. a. Abrasive strips
   b. Cast iron nosing
   c. Aluminum nosing

  - d. Small plain nosing
  - e. Nosing created with safety edger

6. a. To prevent concrete from slumping into lower steps
   - b. To set faster

7. Performance skills evaluated to the satisfaction of the instructor

ON GRADE CURB FORMS
UNIT V

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to define on grade curb forming terms. He should also be able to match various types of curbs and median barriers to their proper names. He should be able to construct forms for a curb and gutter. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with on grade curb forms to the proper definitions.
2. Match illustrations of types of curbs and curbs and gutters to their proper names.
3. Name two methods of forming curbs and gutters or median barriers.
4. Match illustrations of median forms to their proper names.
5. Demonstrate the ability to construct a curb and gutter form.

ON GRADE CURB FORMS
UNIT V

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined in job sheet.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined in the job sheet.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Types of Curbs and Curbs and Gutters
  2. TM 2--Radius Curb and Gutter Forms
  3. TM 3--Radius and Serpentine Forms
  4. TM 4--Manufactured Curb and Gutter Form

5. TM 5--Manufactured Median Barrier Form
6. TM 6--Job-Built Curb and Gutter Forms
7. TM 7--Job-Built Straight Curb with Trench
8. TM 8--Job-Built Median Barrier Form
9. TM 9--Types of Median Barriers

E. Job Sheet #1--Construct a Curb and Gutter Form

F. Test

G. Answers to test

II. Reference: Burke, Arthur E., J. Ralph Dalzell, and Gilbert Townsend. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

ON GRADE CURB FORMS
UNIT V

INFORMATION SHEET

I. Terms and definitions

   A. Brace or kicker--Piece of wood or other material that directs, resists, or supports weight or pressure

   B. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

   C. Form tie--Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

   D. Monolithic pour--Continuous mass of concrete cast as a single unit

   E. Spreader--Block of wood that is used to hold the sides of a form apart and is removed as the concrete is poured; may also be an integral part of the form tie

   F. Mule--Template used to shape the profile of a curb and gutter

   G. Stake--Piece of wood or metal with point on one end; used to hold forms in place

   H. Division plate--Thin steel plate placed between the forms to provide full depth joints in a curb and gutter

   I. Skeleton division plate--Thin steel plate placed between the forms to provide partial depth scoring in curbs and gutters

   J. Median barrier--Barrier placed between two lanes of highway

   K. Subgrade--Soil prepared and compacted to support a structure or a pavement system

   L. Battered--Receding upward slope of the face of a curb

   M. Serpentine curb--Type of curb with several lengthwise curves; resembles serpent

II. Types of curbs and curbs and gutters (Transparencies 1, 2, and 3)

   A. Straight face, vertical

   B. Straight face, battered

   C. Single radius, vertical

INFORMATION SHEET

- D. Single radius, battered
- E. Double radius, vertical
- F. Double radius, battered
- G. Roll type
- H. Highway gutter
- I. Precast
- J. Straight curb
- K. Partially battered curb
- L. Fully battered curb
- M. Radius curb and gutter
- N. Serpentine curb

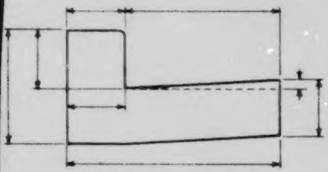
III. Methods of forming curbs and gutters or median barriers (Transparencies 4, 5, 6, 7, and 8)

- A. Manufactured forms
- B. Job-built forms

IV. Types of median forms (Transparency 9)

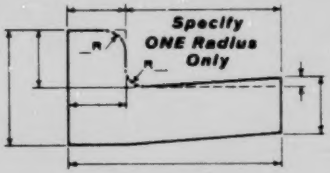
- A. Set on slab
- B. Set on subgrade
- C. One side barrier
- D. Road surfaces at different elevations

Types of Curbs and Curbs and Gutters



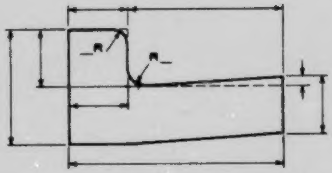
A

STRAIGHT FACE
Vertical


Specify
ONE Radius
Only
R
R

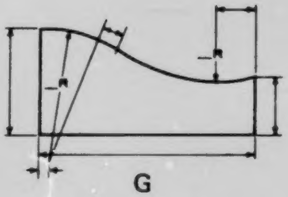
C

SINGLE RADIUS
Vertical



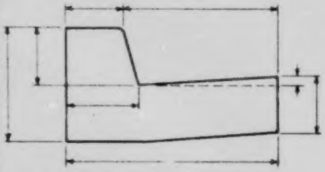
E

DOUBLE RADIUS
Vertical



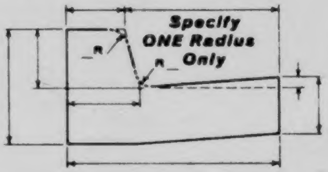
G

ROLL TYPE



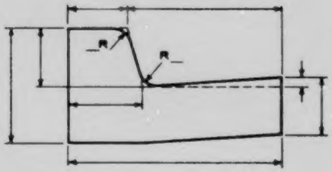
B

STRAIGHT FACE
Battered


Specify
ONE Radius
Only
R
R

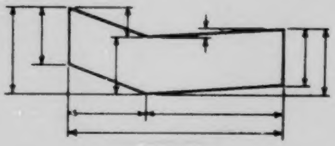
D

SINGLE RADIUS
Battered



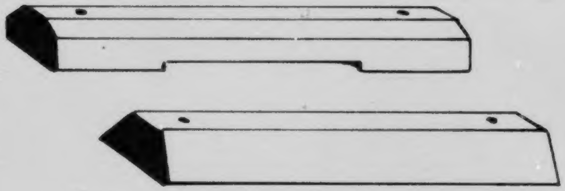
F

DOUBLE RADIUS
Battered



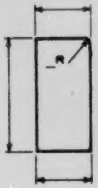
H

HIGHWAY GUTTER



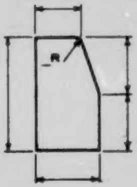
I

PRECAST



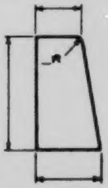
J

STRAIGHT
CURB



K

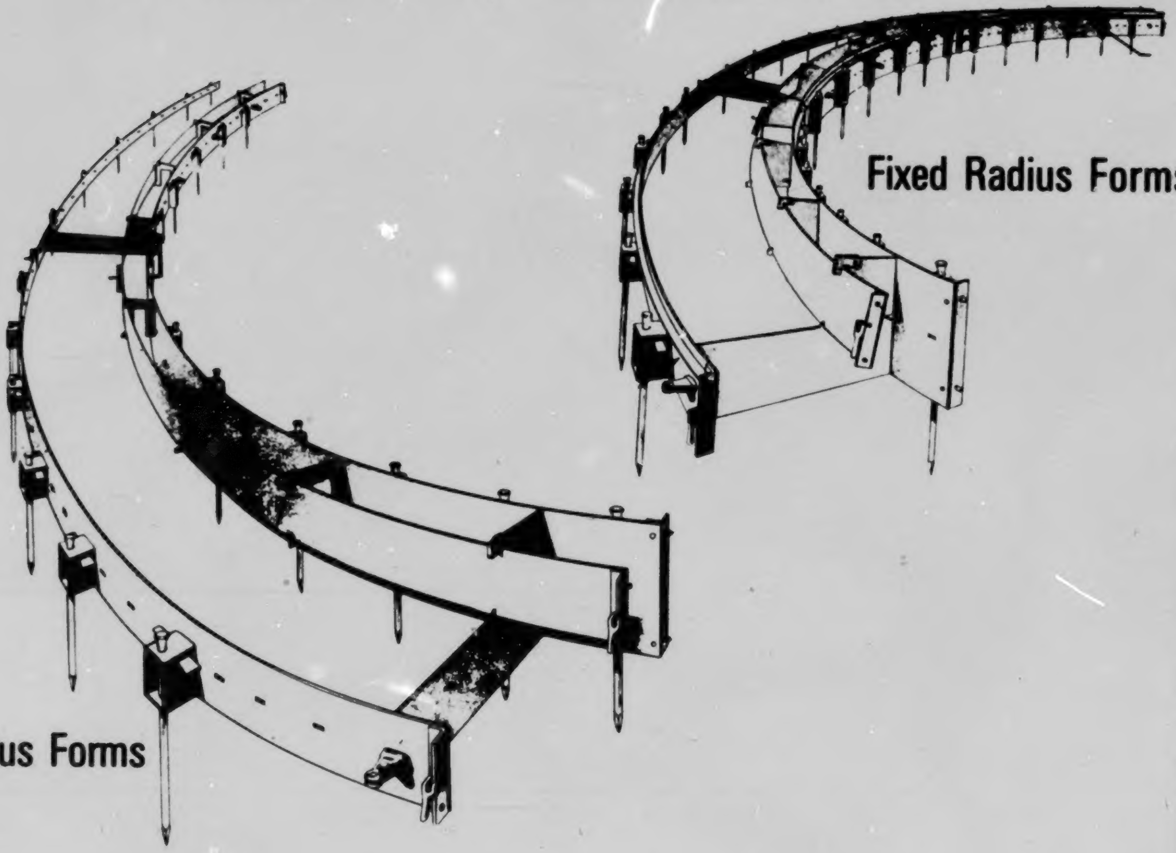
PARTIALLY
BATTERED
CURB



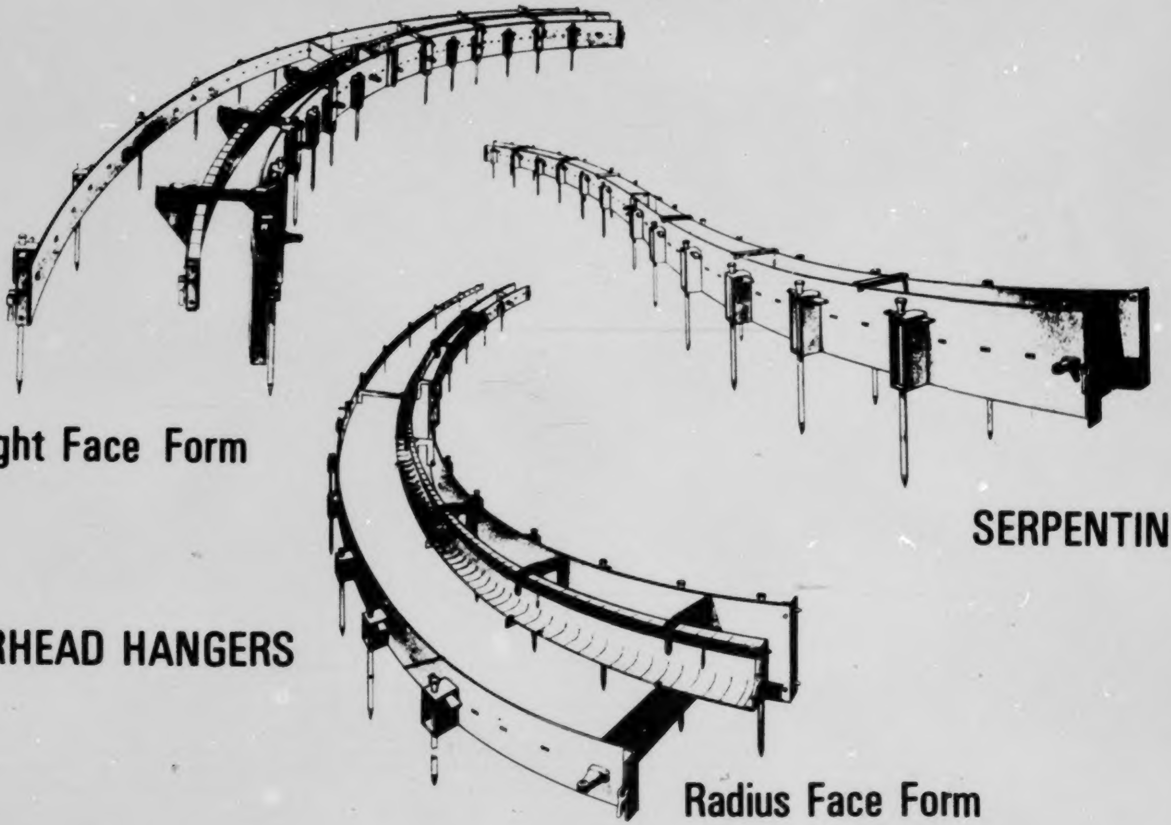
L

FULLY
BATTERED
CURB

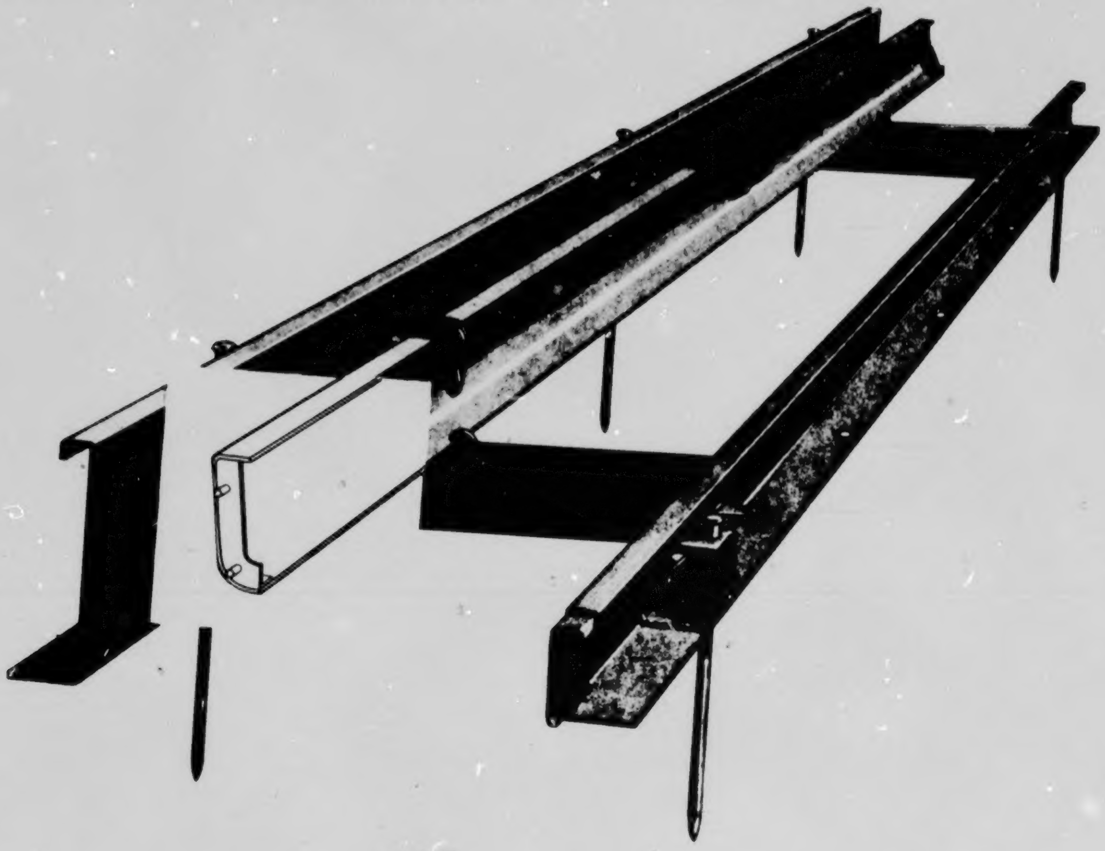
Radius Curb and Gutter Forms


Fixed Radius Forms
Flexible Radius Forms

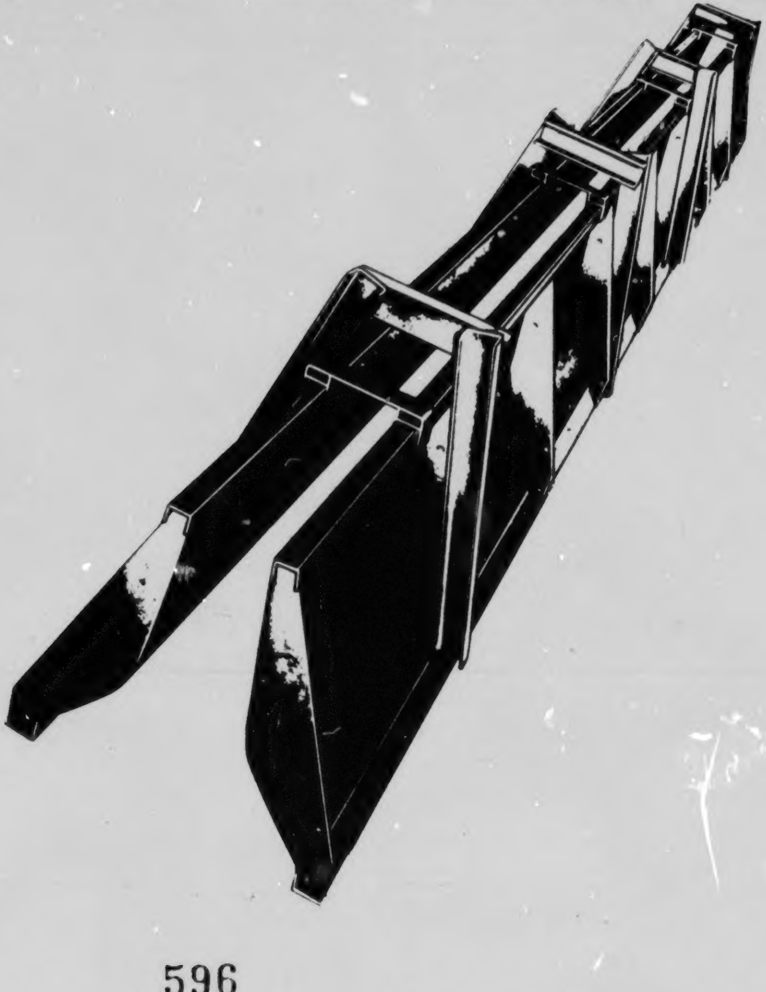
Radius & Serpentine Form


Straight Face Form
SERPENTINE CURBS
OVERHEAD HANGERS
Radius Face Form

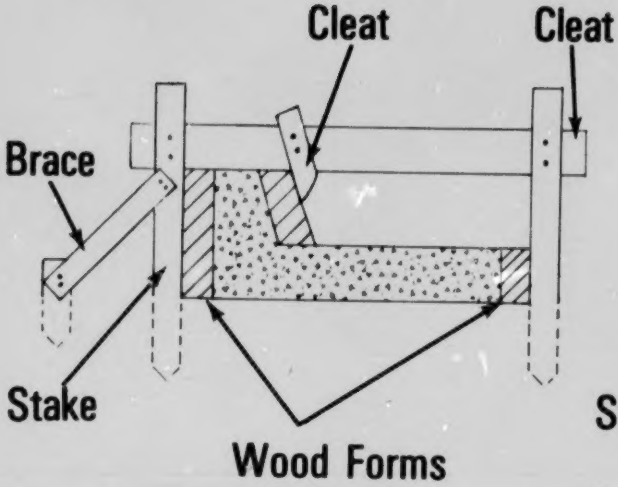
Manufactured Curb and Gutter Form



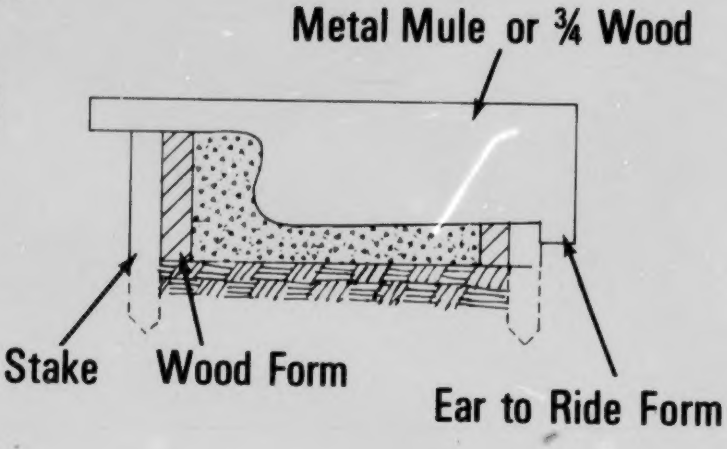
Manufactured Median Barrier Form



Job-Built Curb and Gutter Forms

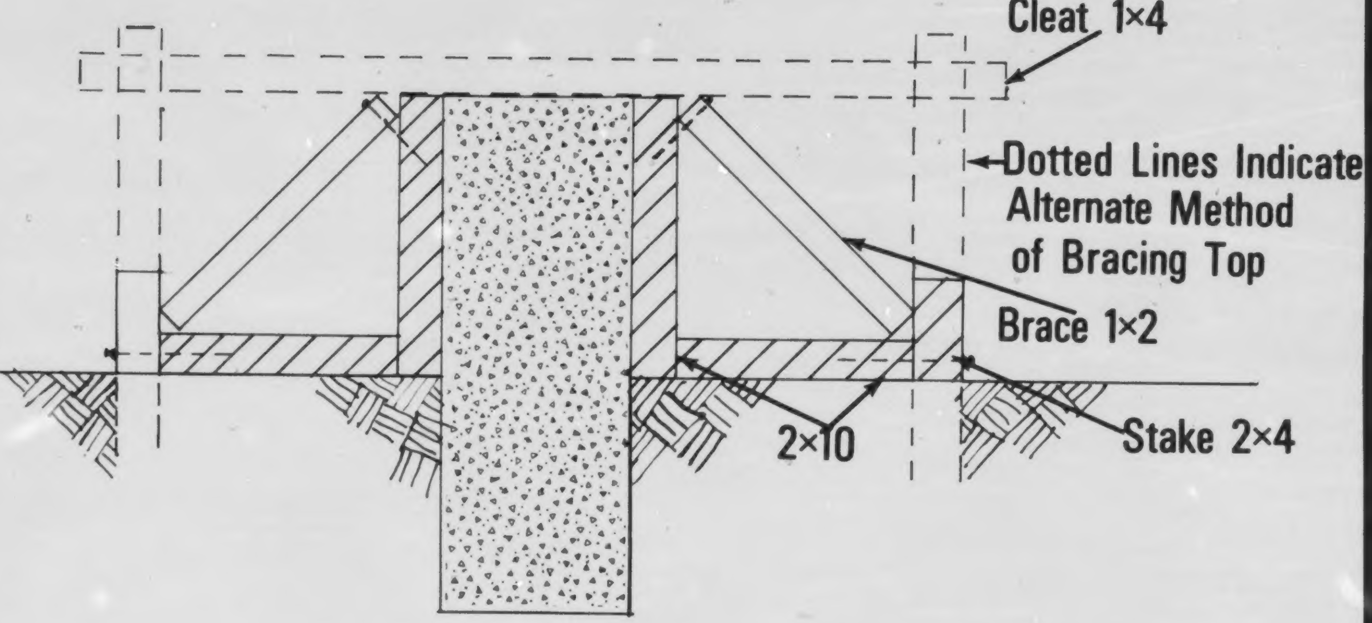

Cleat
Cleat
Brace
Stake
Wood Forms

Curb & Gutter Formed Curb

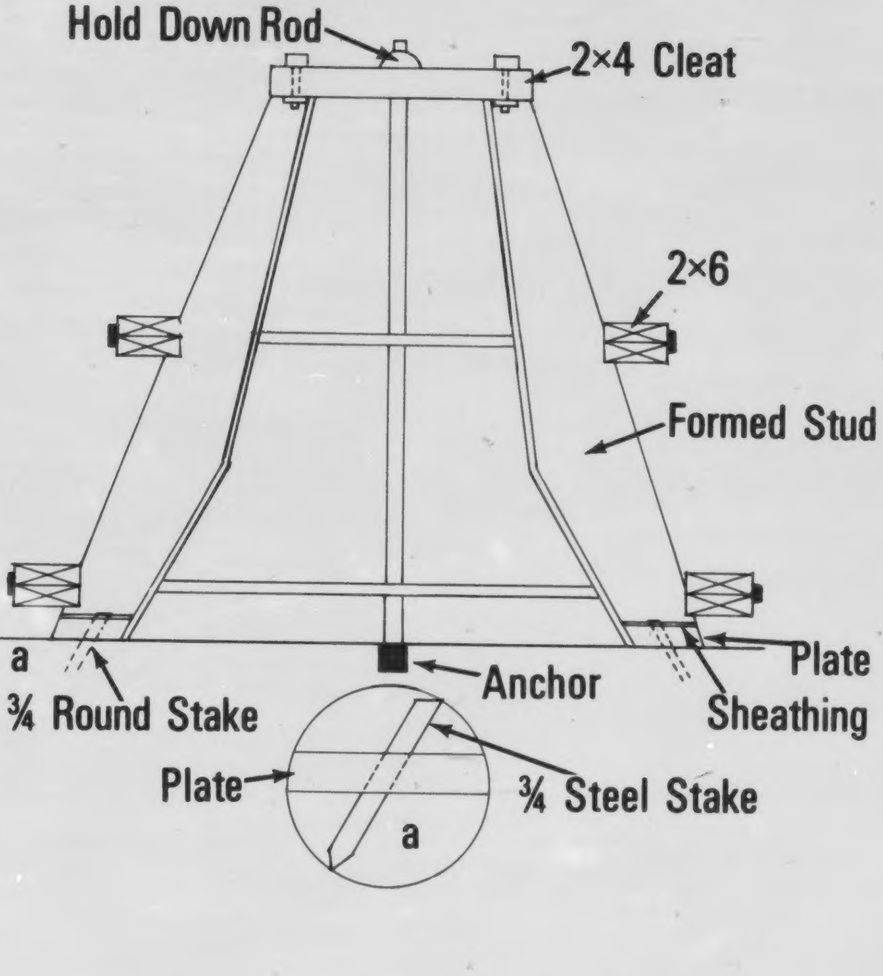

Metal Mule or ¾ Wood
Stake
Wood Form
Ear to Ride Form

Curb & Gutter Mule Formed Curb

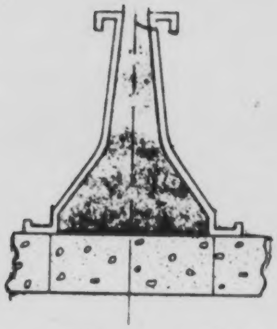
Job-Built Straight Curb with Trench


Cleat 1×4
Dotted Lines Indicate Alternate Method of Bracing Top
Brace 1×2
2×10
Stake 2×4

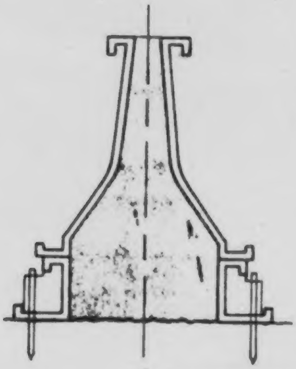
Job-Built Median Barrier Form


Hold Down Rod
2×4 Cleat
2×6
Formed Stud
a
Plate
Anchor
Sheathing
¾ Round Stake
Plate
¾ Steel Stake
a

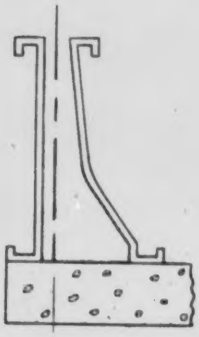
Types of Median Barriers



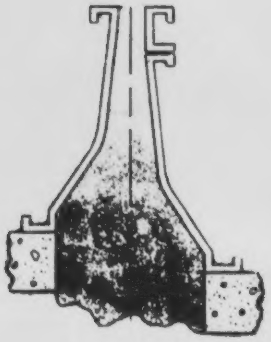
Set on Slab
A



Set on Subgrade
B



One Side Barrier
C



Road Surfaces at Different Elevations
D

ON GRADE CURB FORMS
UNIT V

JOB SHEET #1--CONSTRUCT A CURB AND GUTTER FORM

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer (16 ounce or larger)
3. Electric handsaw
4. Crosscut handsaw
5. 100 foot measuring tape
6. 12 or 16 foot measuring tape
7. Level (hand)
8. String line
9. Builder's level and rod

B. Materials

1. Stakes
2. Sheathing--2 x 10
3. Nails
    a. 16d duplex
    b. 8d duplex

JOB SHEET #1

II. Procedure

A. Establish outside line of curb (Figure 1)

(NOTE: Prior to excavation, offset line and grade stakes have been placed on each side of the road. Check these stakes for offset and elevation.)

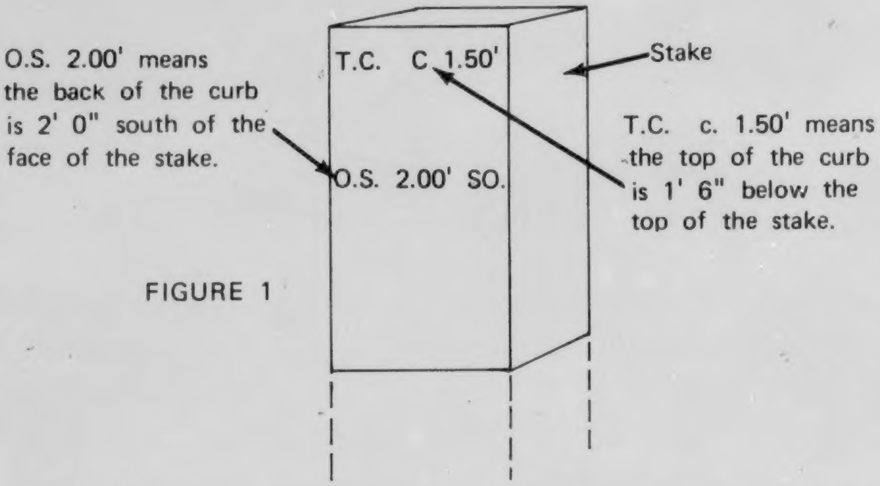
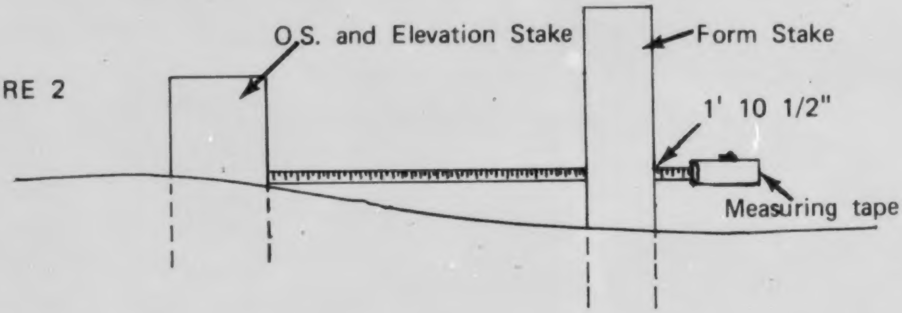

O.S. 2.00' means the back of the curb is 2' 0" south of the face of the stake.
T.C. C 1.50'
Stake
T.C. c. 1.50' means the top of the curb is 1' 6" below the top of the stake.
O.S. 2.00' SO.

FIGURE 1

B. Measure over from offset stake to determine form stake location (Figure 2)

(NOTE: Deduct thickness of the form material from the offset dimension.)

FIGURE 2


O.S. and Elevation Stake
Form Stake
1' 10 1/2"
Measuring tape

JOB SHEET #1

C. Check stakes for elevation as they are driven (Figure 3)

(NOTE: After stake is driven, place pencil mark on elevation of T.C.).

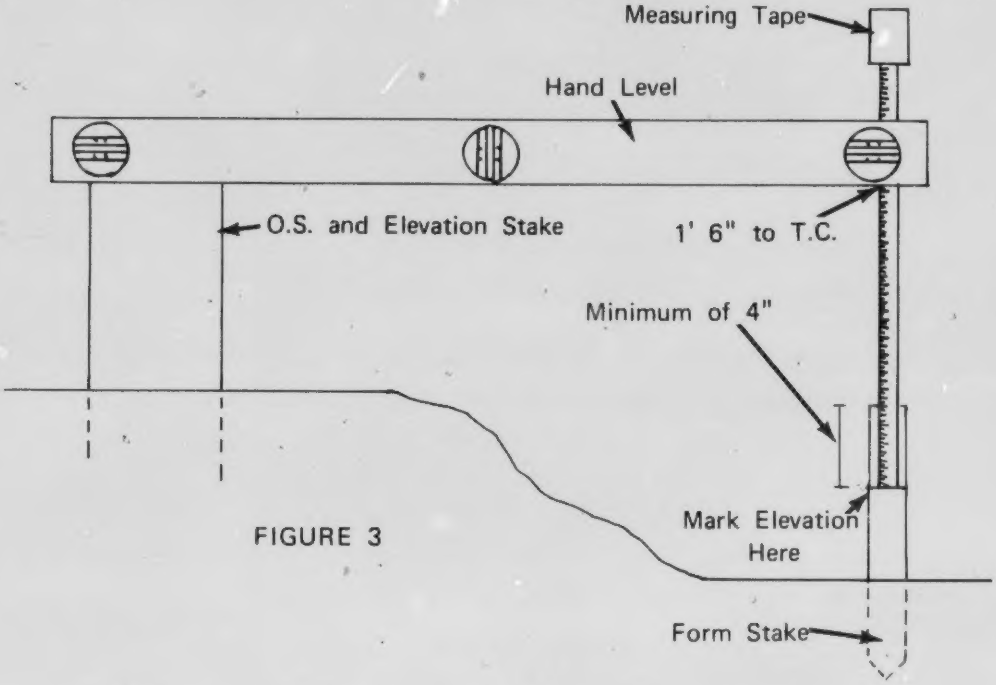

Measuring Tape
Hand Level
O.S. and Elevation Stake
1' 6" to T.C.
Minimum of 4"
Mark Elevation Here
Form Stake

FIGURE 3

D. Drive stakes opposite each offset stake as shown in Figure 3

(NOTE: Offset stakes are usually set every twenty feet.)

E. Lay form material end to end along line of curb

F. Attach line to stakes at elevation and drive intermediate stakes; mark elevation of T.C. on stakes (Figure 4)

(NOTE: Intermediate stake spacing can vary, but a stake must be driven at the joint of each length of form material.)

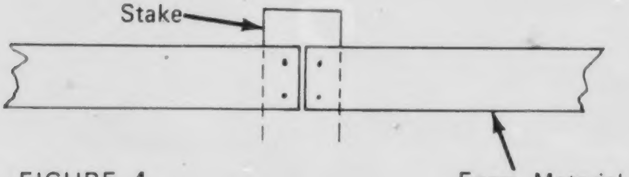

Stake
Form Material

FIGURE 4

JOB SHEET #1

G. Nail form material to stakes

H. Set opposite side stakes using spreader for location (Figure 5)

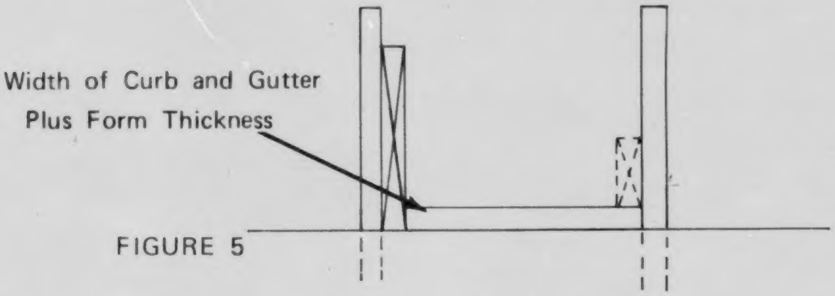

Width of Curb and Gutter
Plus Form Thickness

FIGURE 5

I. Nail form material to stakes

J. Nail a cleat across the stakes to support inside curb form; mark face of curb plus form on cleat (Figure 6)

(NOTE: The inside form may be suspended on stakes driven into the ground if this is permissible. This is a much faster installation.)

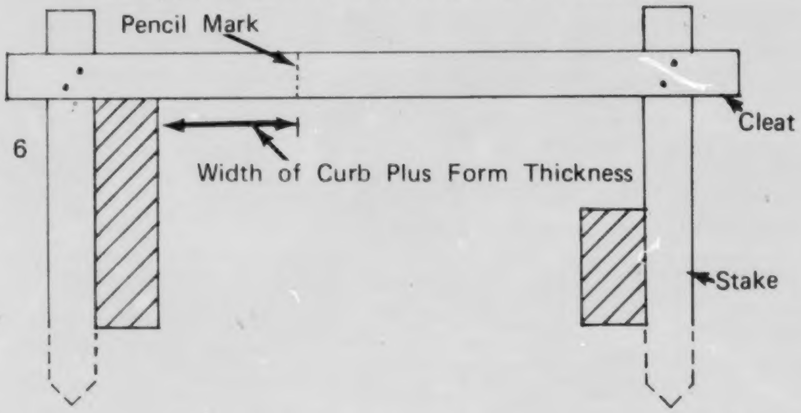

Pencil Mark
Cleat
Width of Curb Plus Form Thickness
Stake

FIGURE 6

(NOTE: The inside form may be clamped into place using hammer clamps and struts. See Figure 7.)

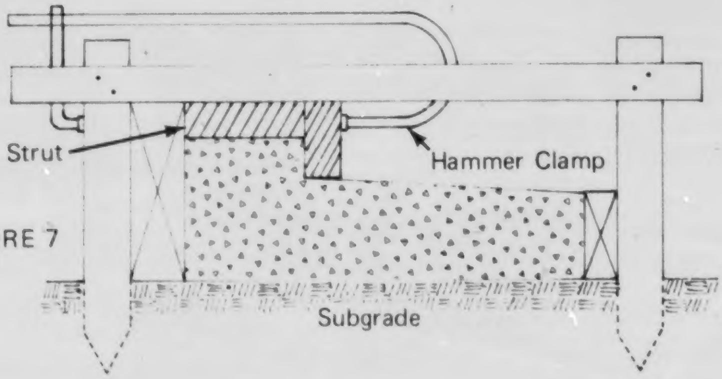

Strut
Hammer Clamp
Subgrade

FIGURE 7

JOB SHEET #1

K. Lay curb face forms on cleats and lay out hanger location (Figure 8)

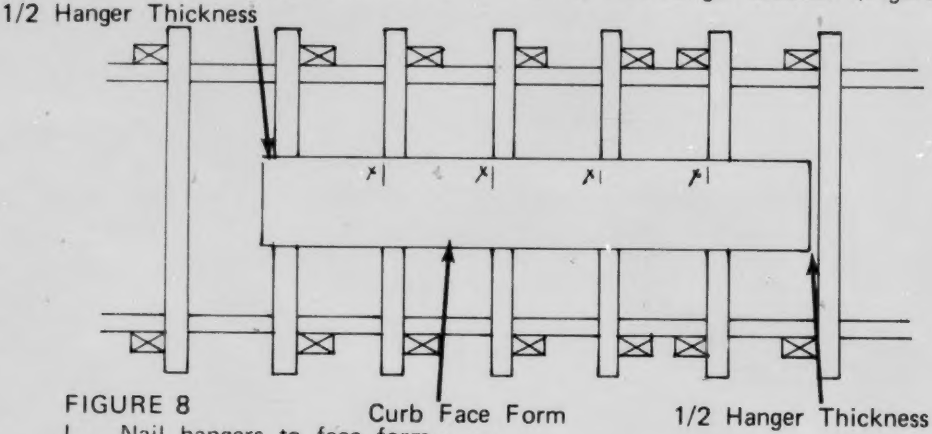

1/2 Hanger Thickness
Curb Face Form
1/2 Hanger Thickness

FIGURE 8

L. Nail hangers to face form

M. Nail hangers to cleat (Figure 9)

(NOTE: All cleats and hangers should be nailed with duplex nails for easy removal.)

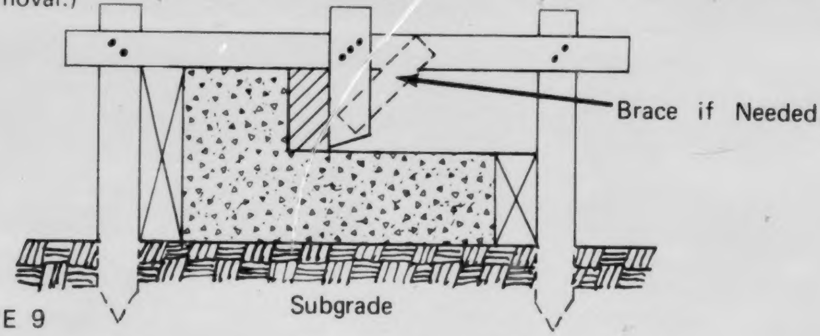

Brace if Needed
Subgrade

FIGURE 9

N. Repeat steps K, L, and M to complete forms

O. If forms need aligning, install braces (Figure 10)

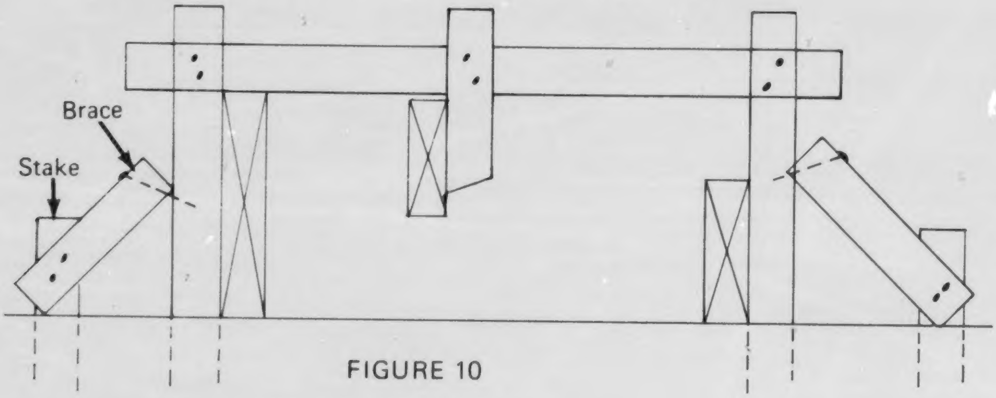

Brace
Stake

FIGURE 10

ON GRADE CURB FORMS
UNIT V

TEST

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Piece of wood or other material that directs, resists, or supports weight or pressure

______b. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

______c. Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

______d. Continuous mass of concrete cast as a single unit

______e. Block of wood that is used to hold the sides of a form apart and is removed as the concrete is poured; may also be an integral part of the form tie

______f. Template used to shape the profile of a curb and gutter

______g. Piece of wood or metal with point on one end; used to hold forms in place

______h. Thin steel plate placed between the forms to provide full depth joints in a curb and gutter

______i. Thin steel plate placed between the forms to provide partial depth scoring in curbs and gutters

______j. Barrier placed between two lanes of highway

______k. Soil prepared and compacted to support a structure or a pavement system

______l. Type of curb with several lengthwise curves; resembles serpent

______m. Receding upward slope of the face of a curb

1. Division plate
2. Stake
3. Median barrier
4. Brace or kicker
5. Subgrade
6. Skeleton division plate
7. Cleat
8. Monolithic pour
9. Mule
10. Form tie
11. Spreader
12. Battered
13. Serpentine curb

2. Match the types of curbs and curbs and gutters illustrated below and on the next page to the proper names. Place the numbers of the illustrations in the blanks provided.

_______a. Partially battered curb

_______b. Highway gutter

_______c. Double radius, battered

_______d. Single radius, vertical

_______e. Straight face, vertical

_______f. Single radius, battered

_______g. Radius curb and gutter

_______h. Roll type

_______i. Serpentine curb

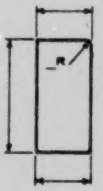
_______j. Fully battered curb

_______k. Straight curb

_______l. Double radius, vertical

_______m. Straight face, battered

_______n. Precast



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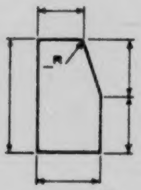

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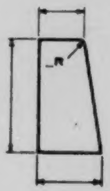

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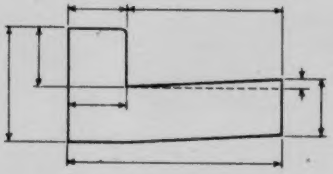

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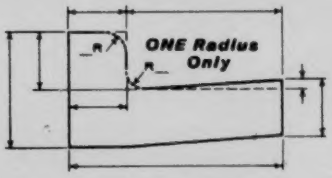

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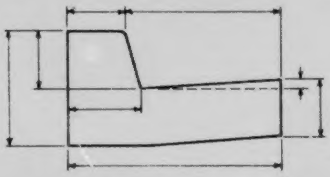

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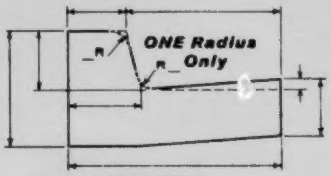

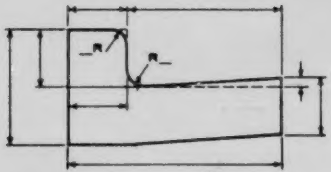

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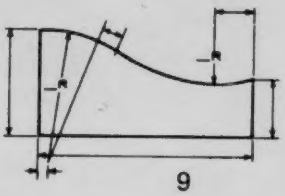

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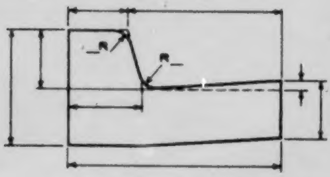

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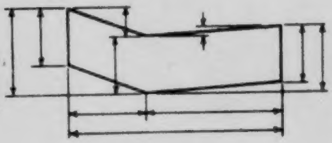

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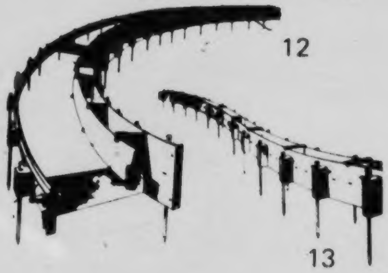

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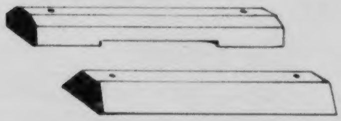


14

3. Name two methods of forming curbs and gutters or median barriers.

   a.

   b.

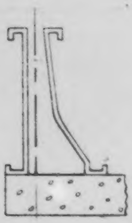
4. Match the types of median forms illustrated below to their proper names. Place the correct numbers in the blanks provided.

   ________a. Set on slab

   ________b. Set on subgrade

   ________c. One side barrier

   ________d. Road surfaces at different elevations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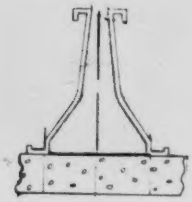
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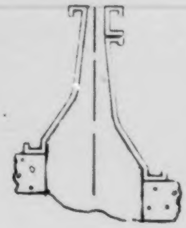
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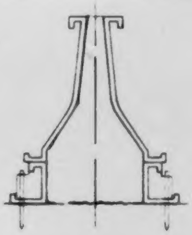

4

5. Demonstrate the ability to construct a curb and gutter form.

   (NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

ON GRADE CURB FORMS
UNIT V

ANSWERS TO TEST

1. a. 4
   b. 7
   c. 10
   d. 8
   e. 11
   f. 9
   g. 2
   h. 1
   i. 6
   j. 3
   k. 5
   l. 13
   m. 12

2. a. 2
   b. 11
   c. 10
   d. 5
   e. 4
   f. 7
   g. 12
   h. 9
   i. 13
   j. 3
   k. 1
   l. 8
   m. 6
   n. 14

3. a. Job-built
   b. Manufactured

4. a. 2
   b. 4
   c. 1
   d. 3

5. Performance skills evaluated to the satisfaction of the instructor

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify types of finishes and joints used in sidewalks and patios. He should be able to demonstrate the ability to finish sidewalks and patios using different types of finishes. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with concrete sidewalks and patios to the proper definitions.
2. Select from a list steps to take before pouring a sidewalk or patio.
3. Arrange in order steps to take when placing and finishing a sidewalk or patio.
4. Identify types of concrete finishes for sidewalks and patios.
5. Identify types of joints used on sidewalks and patios.
6. List three reasons joints are important in walks and patios.
7. Match types of joints to the locations on sidewalks and patios.
8. Select nonskid materials from a list.
9. Demonstrate the ability to:
    a. Place and finish sidewalk with float finish.
    b. Place and finish sidewalk with fine swirl finish.
    c. Place and finish sidewalk with fine broom finish.
    d. Place and finish sidewalk with exposed aggregate finish.
    e. Place and finish sidewalk with swirl finish using nonskid material.
    f. Place and finish sidewalk with rock salt finish.
    g. Place and finish sidewalk with travertine or keystone finish.

h. Place and finish sidewalk with geometric finish.

i. Place and finish sidewalk with fine swirl finish using ready-mix color.

j. Place and finish sidewalk with fine broom finish using color with dry shake method.

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Types of Joints for Sidewalks and Patios

    2. TM 2--Types of Joints for Sidewalks and Patios (Continued)

3. TM 3--Types of Joints for Sidewalks and Patios (Continued)
4. TM 4--Details of Control Joints
5. TM 5--Spacing of Joints on Sidewalks

D. Job sheets

1. Job Sheet #1--Place and Finish Sidewalk with Float Finish
2. Job Sheet #2--Place and Finish Sidewalk with Fine Swirl Finish
3. Job Sheet #3--Place and Finish Sidewalk with Fine Broom Finish
4. Job Sheet #4--Place and Finish Sidewalk with Exposed Aggregate Finish
5. Job Sheet #5--Place and Finish Sidewalk with Swirl Finish Using Nonskid Material
6. Job Sheet #6--Place and Finish Sidewalk with Rock Salt Finish
7. Job Sheet #7--Place and Finish Sidewalk with Travertine or Keystone Finish
8. Job Sheet #8--Place and Finish Sidewalk with Geometric Finish
9. Job Sheet #9--Place and Finish Sidewalk with Fine Swirl Finish Using Ready-Mix Color
10. Job Sheet #10--Place and Finish Sidewalk with Fine Broom Finish Using Color with Dry Shake Method

II. Reference--*Outdoor Landscaping with Concrete: How to Build Walks, Drives, Patios, and Steps.* Skokie, Illinois: Portland Cement Association, 1971.

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

INFORMATION SHEET

I. Terms and definitions

   A. Joints--Grooves sawed or tooled in concrete

   B. Jointer--Tool used to cut grooves in concrete

   C. Subgrade--Soil prepared and compacted to support a structure or a pavement system

   D. Swirl finish--Process of troweling concrete and leaving surface with a fuzzy, fanlike pattern

   E. Exposed aggregate finish--Type of finish where aggregate is exposed through a wash and broom process

   F. Keystone or travertine finish--Type of finish that is produced by dashing a soupy mixture of mud on surface and then troweling

   G. Rock salt finish--Type of finish produced by working salt into surface and then washing salt away after curing

   H. Geometric finishes--Variety of finishes and/or patterns used on walks and patios

   I. Stamping pads--Tools used to make a design on the surface of concrete

   J. Construction joint--Joint placed where pour is temporarily suspended

   K. Control joint--Joint cut in concrete to induce cracking at this point rather than at random

   L. Isolation joint--Joint cut to isolate one section of concrete from another or to cut around rigid objects

   M. Expansion joint material--Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

   N. Nonskid material--Abrasive material sprinkled on surface of concrete and worked in to create a nonskid surface

   O. Aluminum oxide grits--Very hard, abrasive grains

   P. Silicon carbide grits--Very hard, irridescent, abrasive compound

INFORMATION SHEET

- Q. Mud--Mixture of sand, cement, and water
- R. Surface retarder--Agent applied to the concrete surface to keep it from setting too fast; usually used on exposed aggregate work
- S. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete
- T. Vapor barrier--Layer of material used to prevent the absorption of moisture
- U. Seed--To sprinkle aggregate on surface of concrete when finishing exposed aggregate work
- V. Dry shake--Application of a dry color or topping material

II. Steps to take before pouring a sidewalk or patio

- A. Put down vapor barrier
- B. Set forms to grade
- C. Make sure there is proper slope for drainage
- D. Check that subgrade is on grade and relatively smooth
- E. Wet down subgrade if necessary

III. Steps to take when placing and finishing a sidewalk or patio

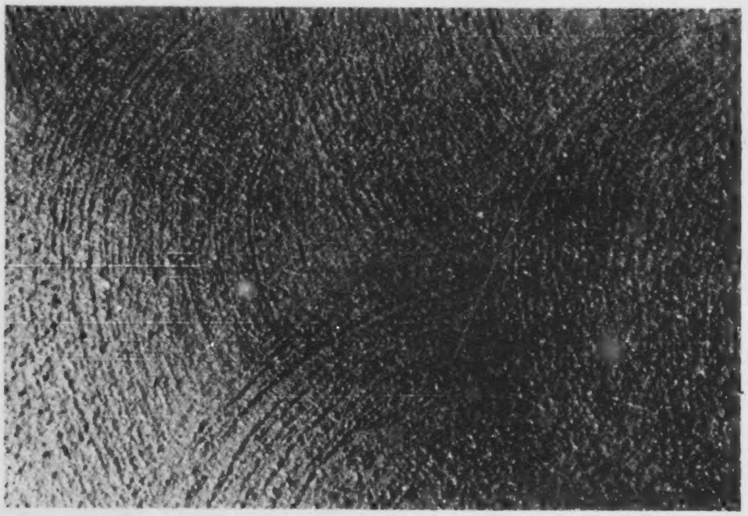
- A. Rod
- B. Jitterbug or rollerbug

  (NOTE: Used only where low slump concrete is used.)
- C. Darby or bullfloat
- D. Hand float
- E. Trowel
- F. Edge
- G. Cut joints
- H. Finish

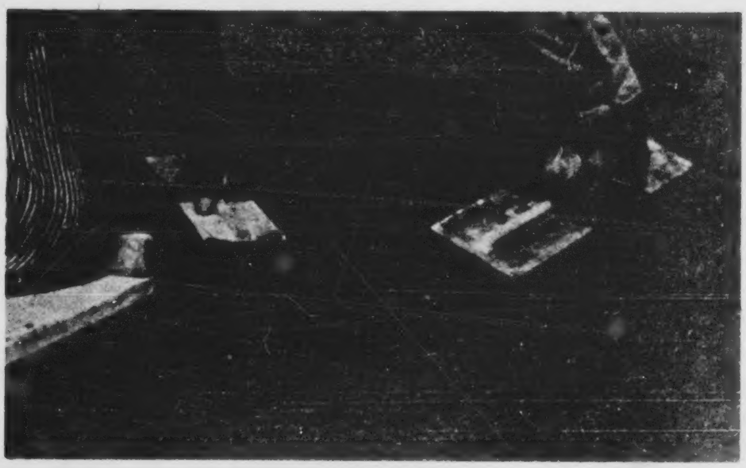
INFORMATION SHEET

IV. Types of concrete finishes for sidewalks and patios

A. Float

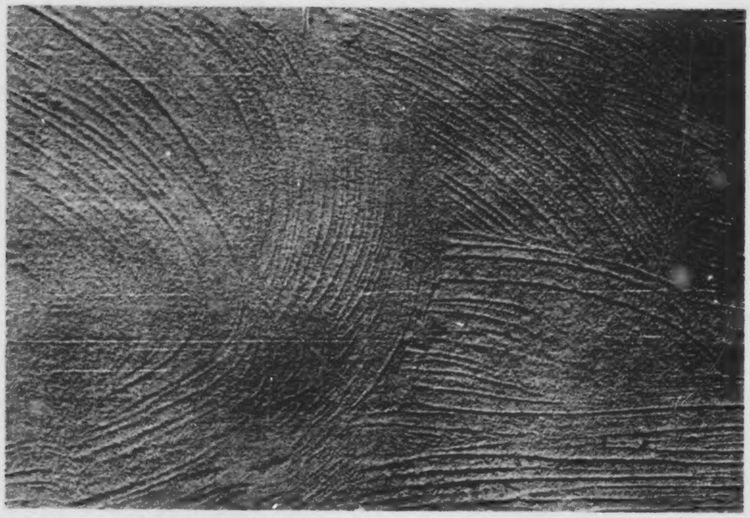


B. Trowel

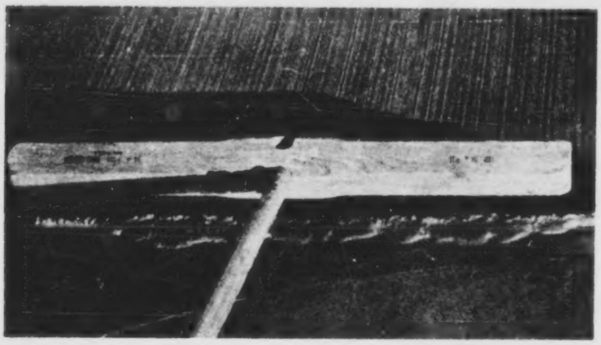


INFORMATION SHEET

C. Swirl

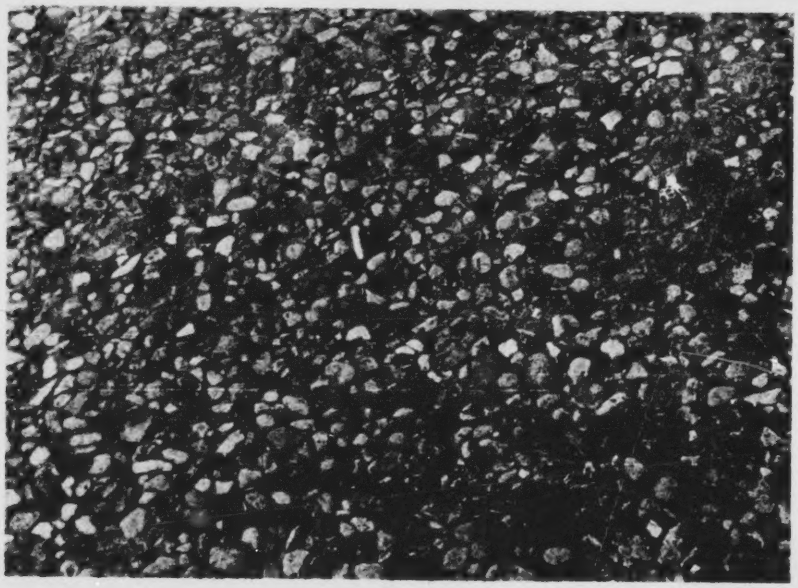


D. Broom

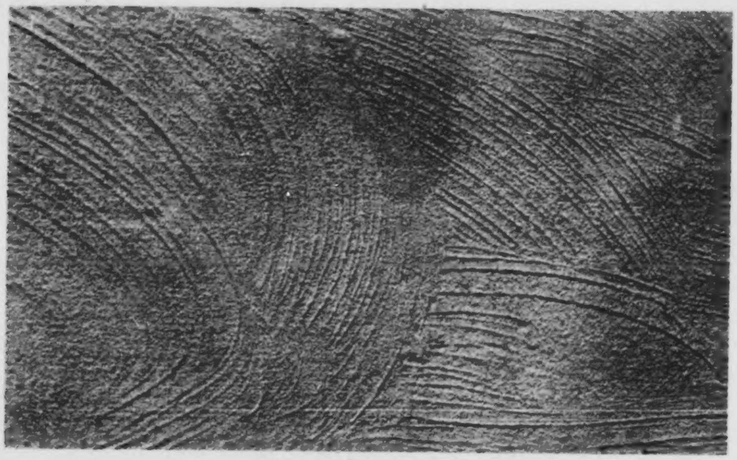


INFORMATION SHEET

E. Exposed aggregate

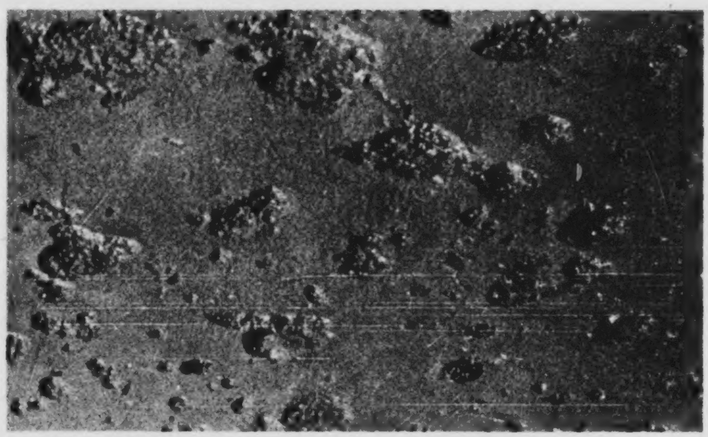


F. Swirl with nonskid material

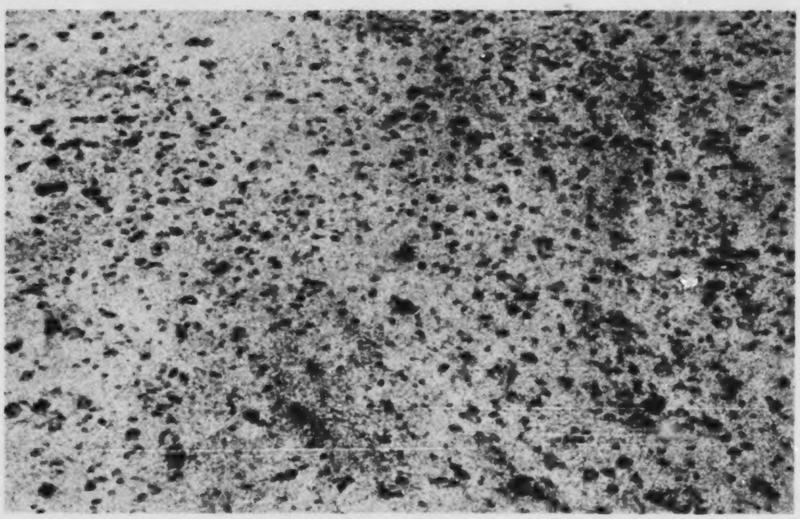


INFORMATION SHEET

G. Keystone or travertine



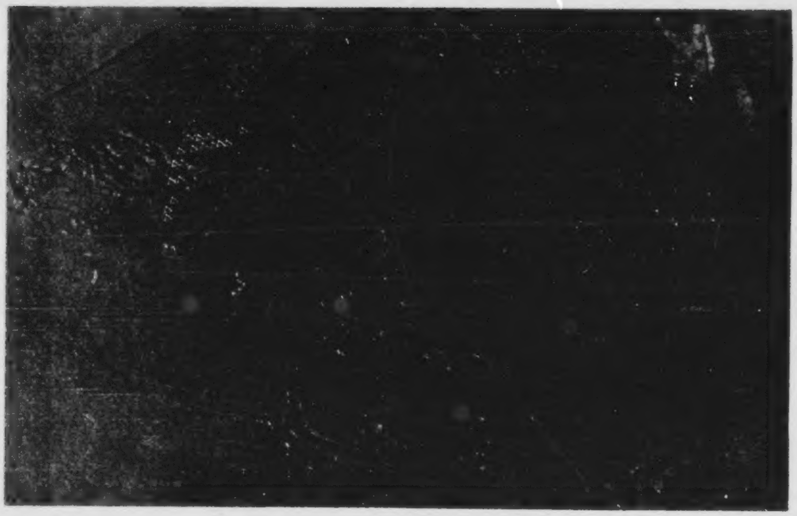
H. Rock salt



INFORMATION SHEET

I. Geometric

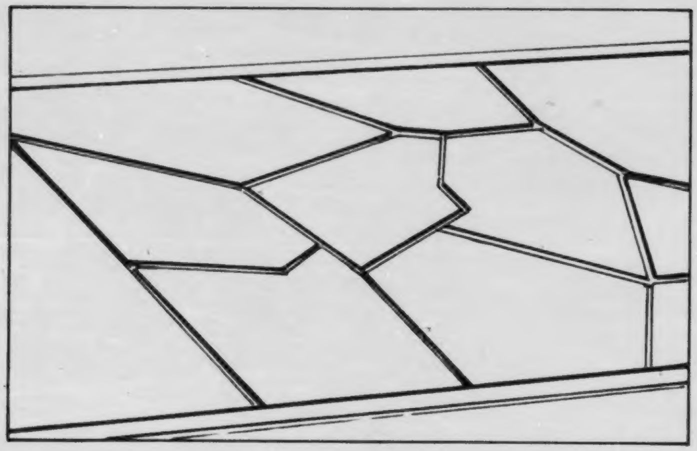
1. Leaf pattern



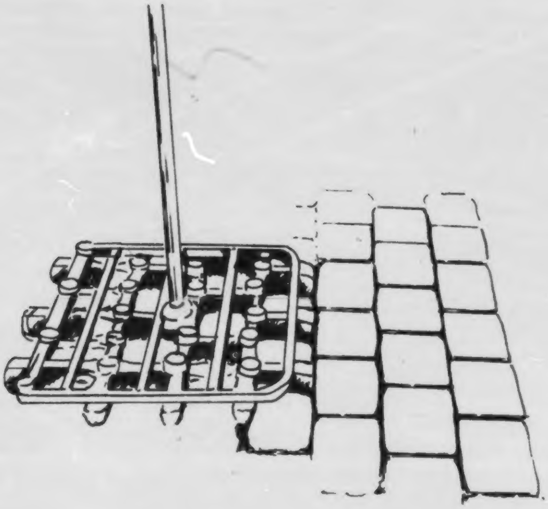
2. Circle

INFORMATION SHEET

3. Flagstone



4. Stamping pads



INFORMATION SHEET

J. Colored

V. Types of joints used on sidewalks and patios (Transparencies 1-3)

   A. Construction

   B. Control or contraction

   C. Expansion or isolation

   D. Decorative

VI. Reasons joints are important in walks and patios

   A. Eliminate random cracks

   B. Allow for expansion and contraction

   C. Enhance the appearance

   (CAUTION: Control joints should be cut at least one-fifth the depth of the slab. See Transparency 4.)

VII. Types of joints and their locations on sidewalks and patios (Transparency 5)

   A. Control joint

      1. Spaced at intervals about equal to width of walk

      2. Patios larger than ten to twelve feet should have lengthwise joint down center

INFORMATION SHEET

(NOTE: On large patios and walks, control joints should not exceed ten feet in either direction. Control joints can be cut with a jointer or sawed after concrete hardens.)

B. Expansion or isolation joint

1. Points of potential stress

2. Intersections of concrete

3. Where walks and patios adjoin other slabs, buildings, and curbs

(NOTE: Expansion joint material for walks is usually a premolded compressible material one-half inch thick.)

(CAUTION: Expansion joints should be the full depth of concrete.)

C. Construction joint--Where pour is temporarily suspended

D. Decorative joint--To create decorative pattern

(NOTE: Decorative joints can be accomplished with jointers, stamps (homemade or commercial), imbedded asphalt strips, wood strips, plastic, and metal. They are sometimes called dummy joints.)

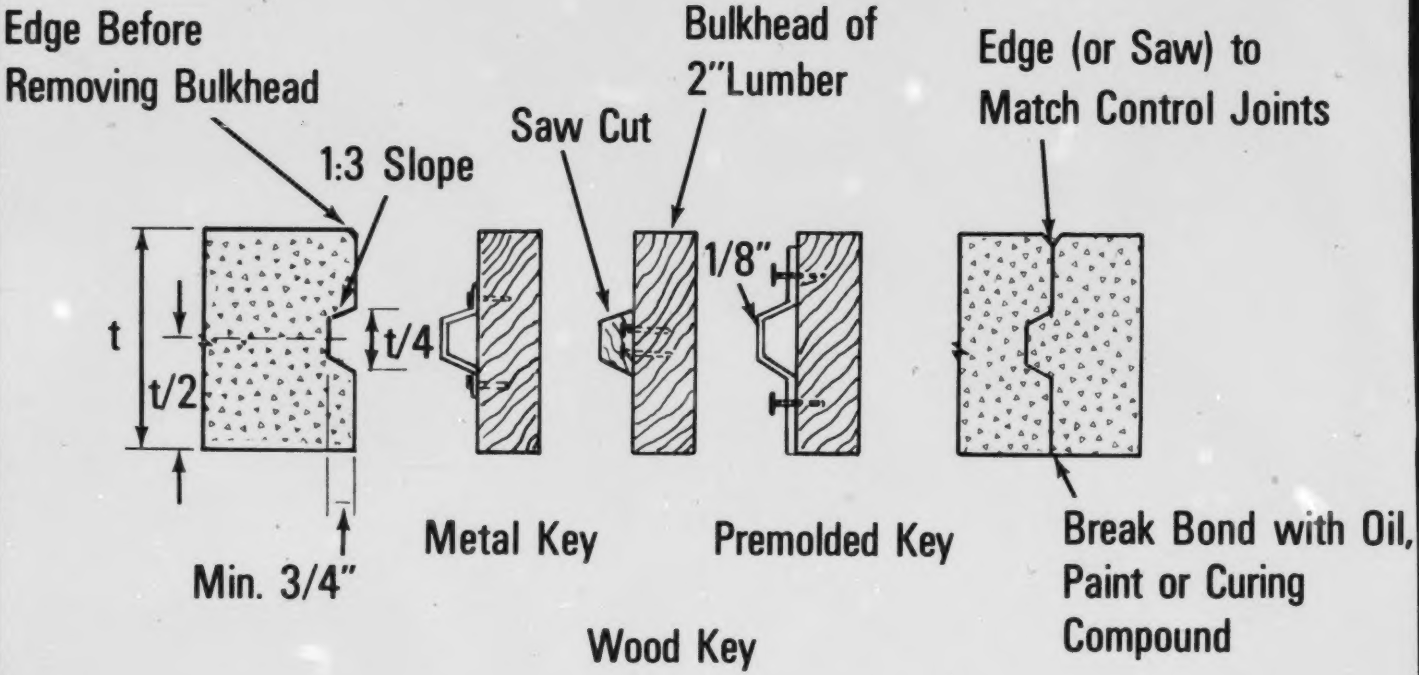
VIII. Nonskid materials

A. Silicon carbide grits

B. Aluminum oxide grits

(NOTE: Nonskid abrasive materials can be obtained in different size grits.)

Types of Joints for Sidewalks and Patios

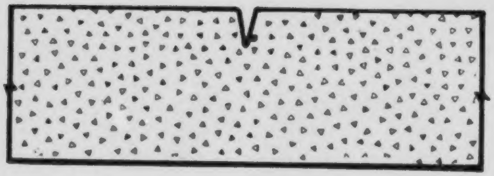

Edge Before
Removing Bulkhead
1:3 Slope
Saw Cut
Bulkhead of
2"Lumber
Edge (or Saw) to
Match Control Joints
t
t/2
t/4
1/8"
Min. 3/4"
Metal Key
Premolded Key
Wood Key
Break Bond with Oil,
Paint or Curing
Compound

Construction Joints

Types of Joints for Sidewalks and Patios

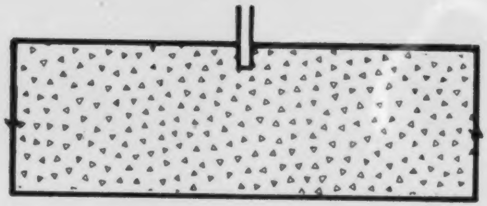
(Continued)

CONTROL JOINTS

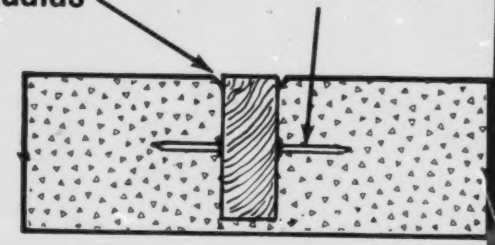


Hand Tooled Control Joint

Sawed Control Joint

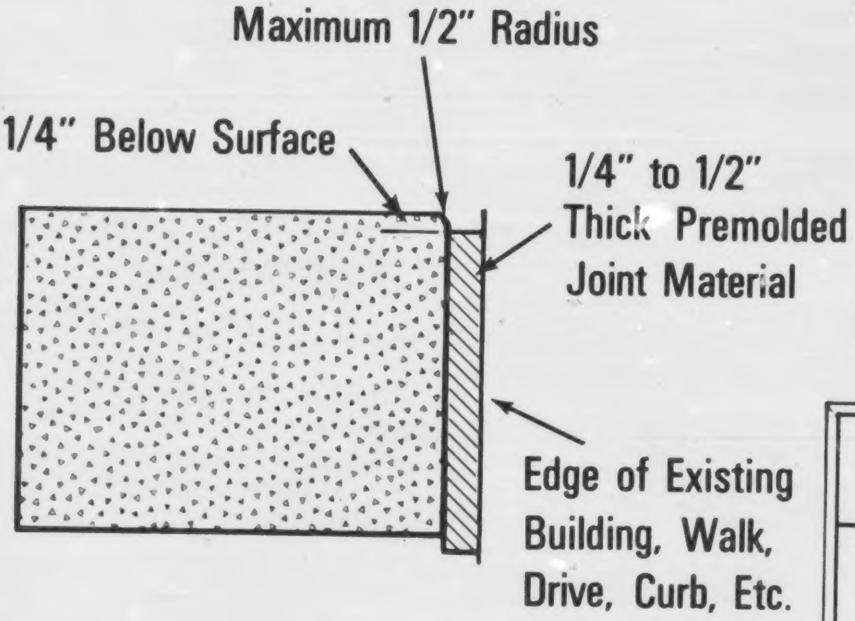


Wood Divider Strip

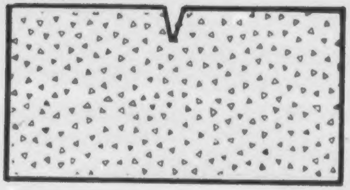

1/2" Maximum Radius
16 Penny Nail

Types of Joints for Sidewalks and Patios

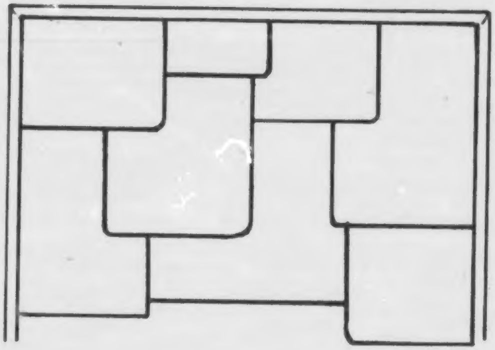
(Continued)


Maximum 1/2" Radius
1/4" Below Surface
1/4" to 1/2" Thick Premolded Joint Material
Edge of Existing Building, Walk, Drive, Curb, Etc.

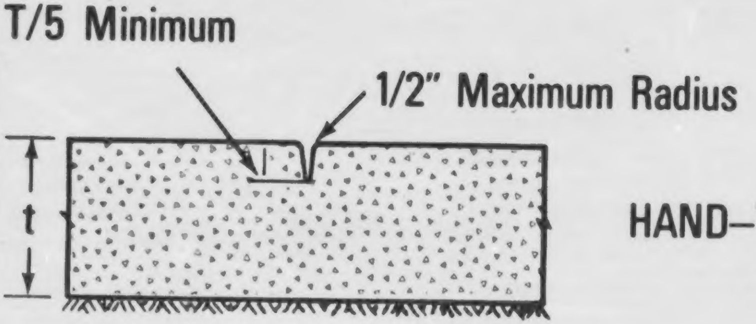
Expansion Joint



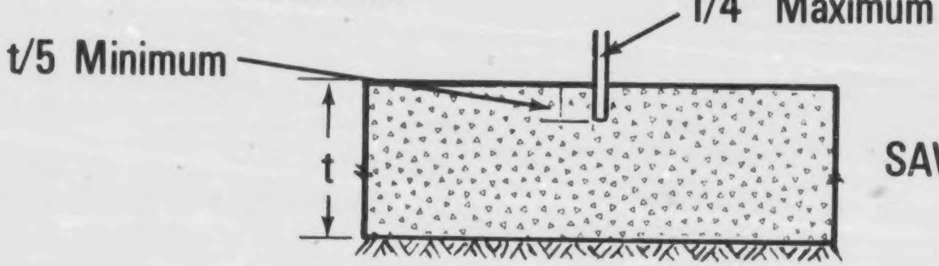
Decorative Joint



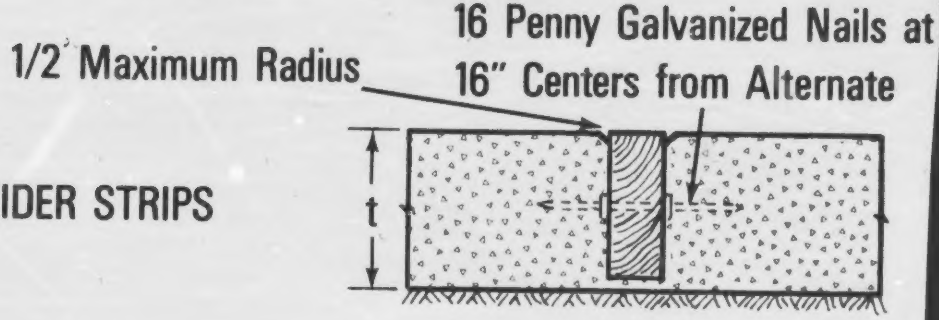
Details of Control Joints


T/5 Minimum
1/2" Maximum Radius
t

HAND–TOOLED CONTROL JOINT

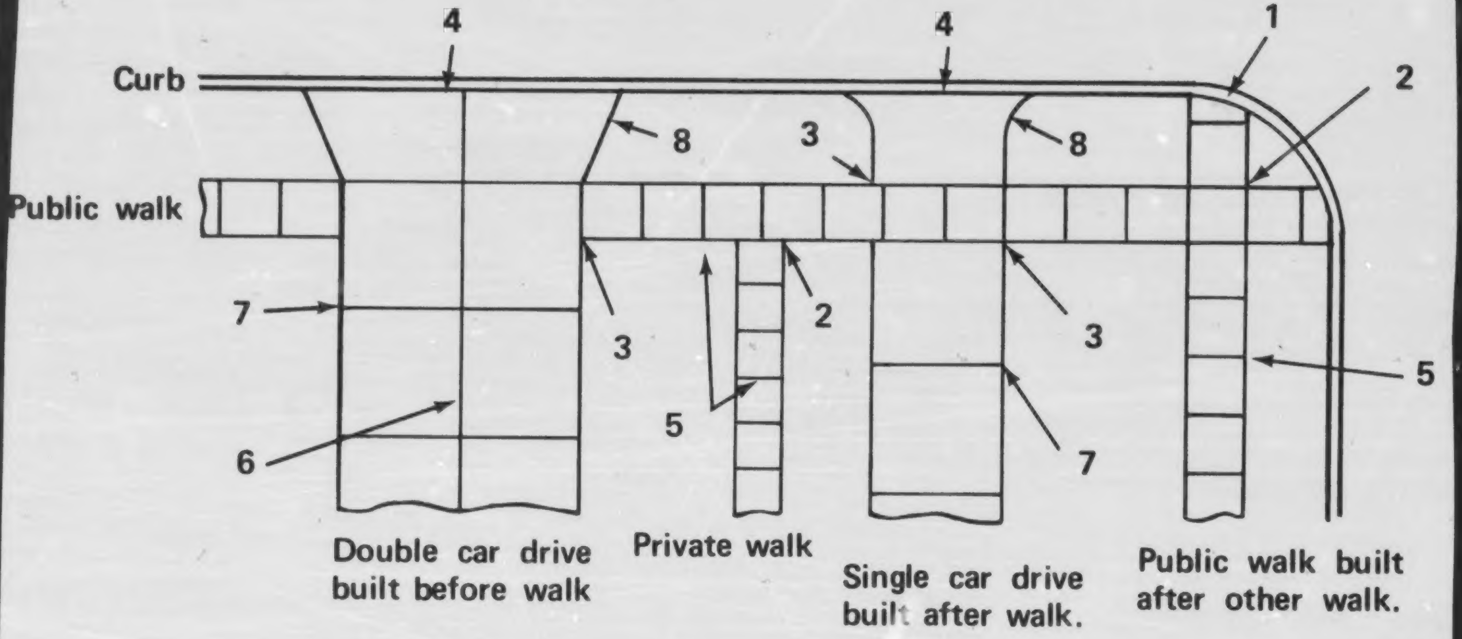

1/4" Maximum
t/5 Minimum
t

SAWED CONTROL JOINT


16 Penny Galvanized Nails at
16" Centers from Alternate
1/2 Maximum Radius
t

WOOD DIVIDER STRIPS

Spacing of Joints on Sidewalks


4
4
1
Curb
2
8
3
8
Public walk
7
3
2
3
5
5
6
7
Double car drive built before walk
Private walk
Single car drive built after walk.
Public walk built after other walk.

1 Isolation joint between walk and curb.
2 Isolation joint where walks meet.
3 Isolation joint between walk and drive.
4 Isolation joint between drive and curb.
5 Control joints in walks form square panels.
6 Longitudinal control joint down center of double car drive.
7 Control joints in drives at 10-ft. intervals.
8 Radius or flare at drive entrances

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #1--PLACE AND FINISH SIDEWALK WITH FLOAT FINISH

I. Tools and materials

  A. Tools

    1. Straightedge
    2. Bullfloat
    3. Hand floats
    4. Edger
    5. Jointer
    6. Margin trowel
    7. Brush
    8. Sprayer

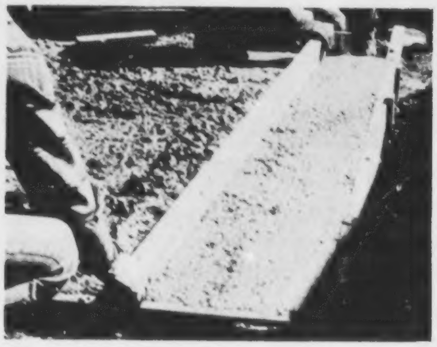
  B. Materials

    1. Concrete
    2. Bucket of water
    3. Curing agents

II. Procedure

  A. Place concrete at starting point (Figure 1)

FIGURE 1



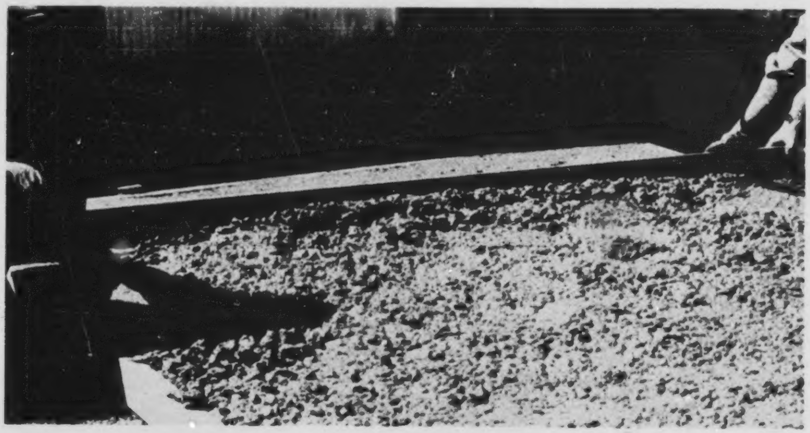
JOB SHEET #1

B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

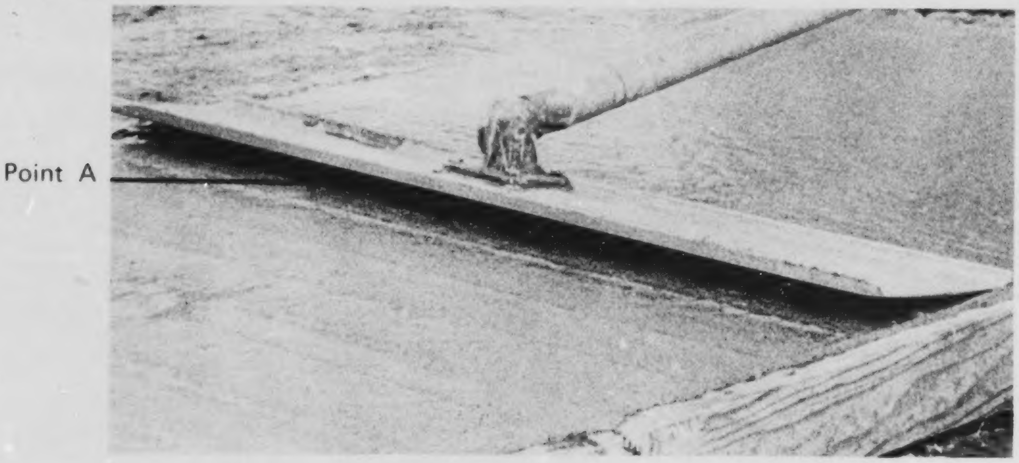
FIGURE 2



C. Bullfloat surface with a forward and backward movement across walk immediately after rodding

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

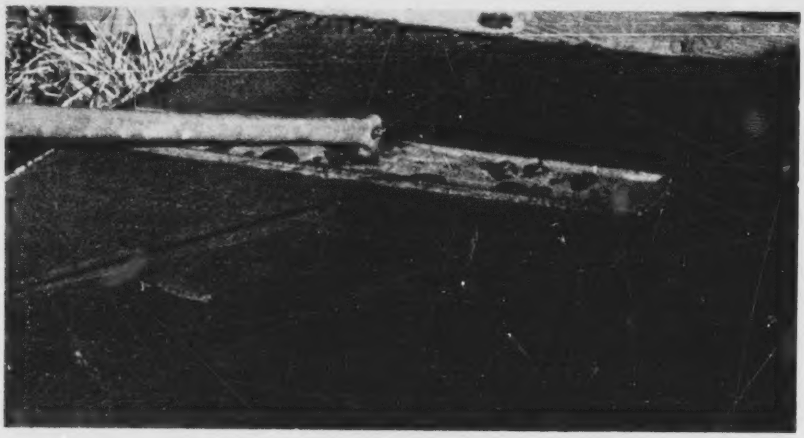
FIGURE 3



JOB SHEET #1

E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

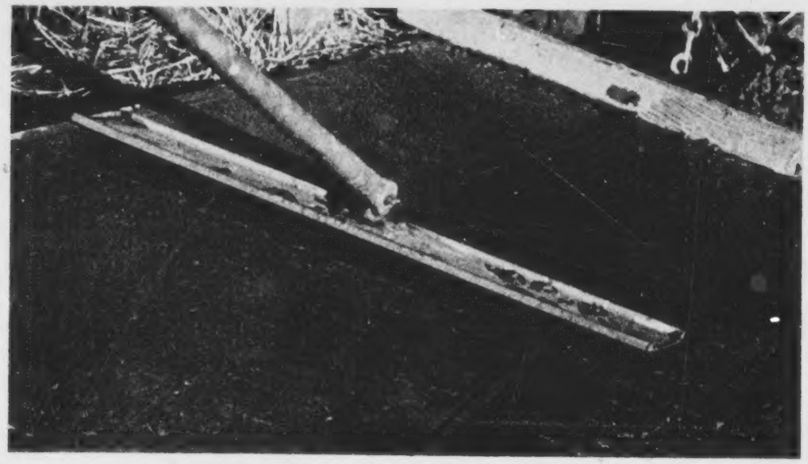
FIGURE 4



Point B

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



Point B

G. Overlap previous pass slightly and continue process until walk has been floated

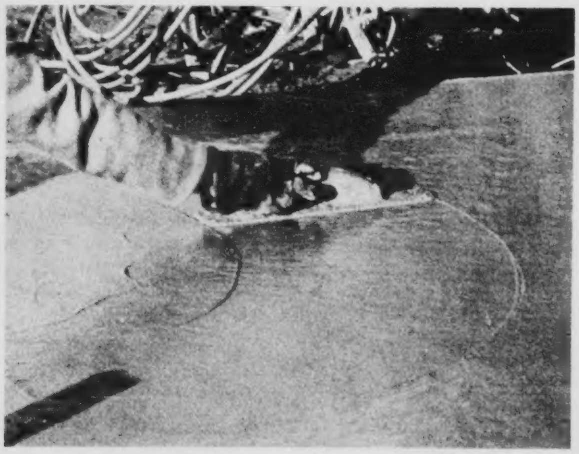
(CAUTION: Occasionally, a time period needs to elapse after bullfloating to allow concrete to harden and the bleed water to leave; this is not usually so when using air-entrained concrete.)

JOB SHEET #1

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to the surface (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

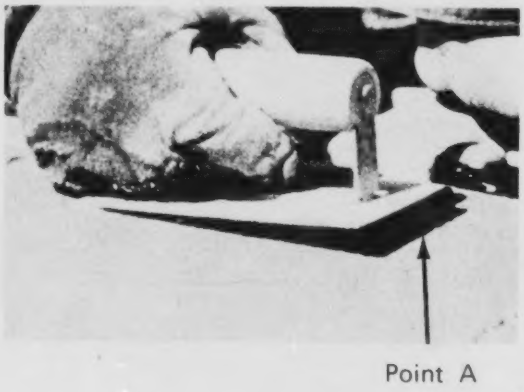
FIGURE 6



I. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 7)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

FIGURE 7

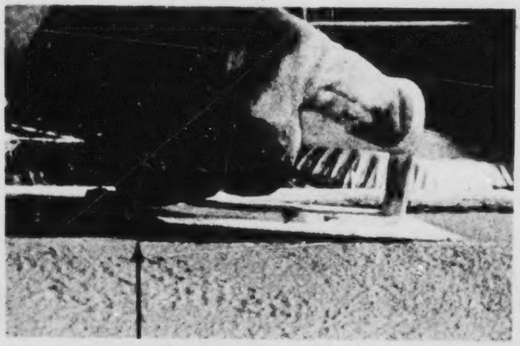


JOB SHEET #1

J. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 8)

(CAUTION: To avoid low places, do not place too much pressure on edger.)

FIGURE 8



Point B

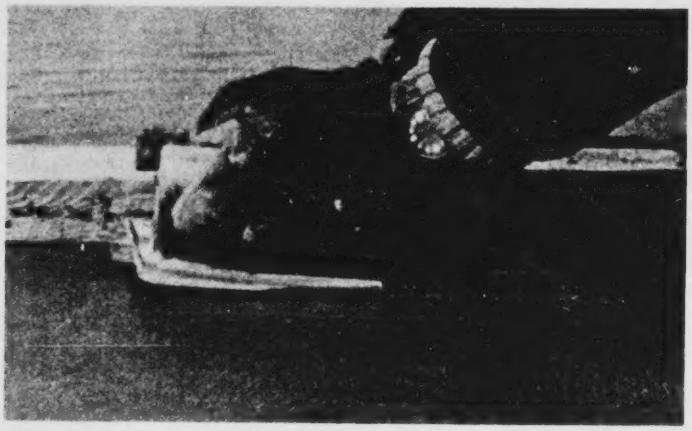
K. Continue this procedure until all edges are rounded and smooth

L. Edge all expansion joints, following edging procedure and taking all precautions

M. Use rule or tape to measure and mark all joints as specified

N. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 9)

FIGURE 9



JOB SHEET #1

O. Reverse tool and pull back over the joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

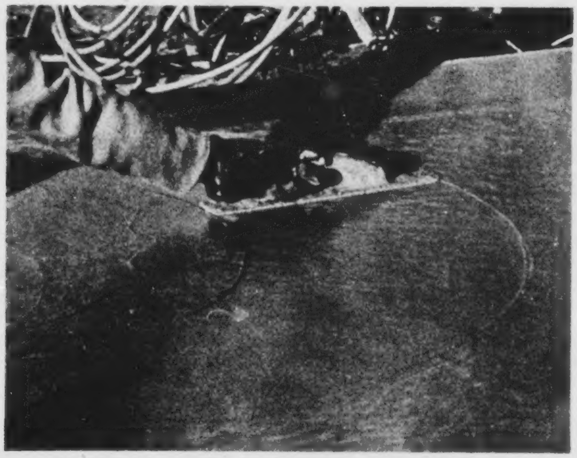
P. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and wide chisel to make first cut; then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be otained.)

Q. Start finish floating at point of first floating or at hardest point of concrete

R. Move in a semicircular fanlike motion with float flat to surface and at arm's length (Figure 10)

FIGURE 10



JOB SHEET #1

S. Continue this procedure until entire walk is finished (Figure 11)

FIGURE 11

T. Use jointer and edger after floating to smooth out joints and edges

U. Apply curing agent using sprayer with nozzle adjusted to a fine mist

V. Use margin trowel to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #2--PLACE AND FINISH SIDEWALK WITH FINE SWIRL FINISH

I. Tools and materials

   A. Tools

      1. Straightedge
      2. Bullfloat
      3. Hand floats
      4. Finishing trowel
      5. Edger
      6. Jointer
      7. Margin trowel
      8. Sprayer
      9. Brush

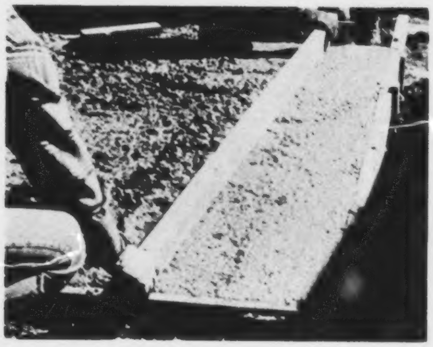
   B. Materials

      1. Concrete
      2. Curing agent
      3. Water

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1



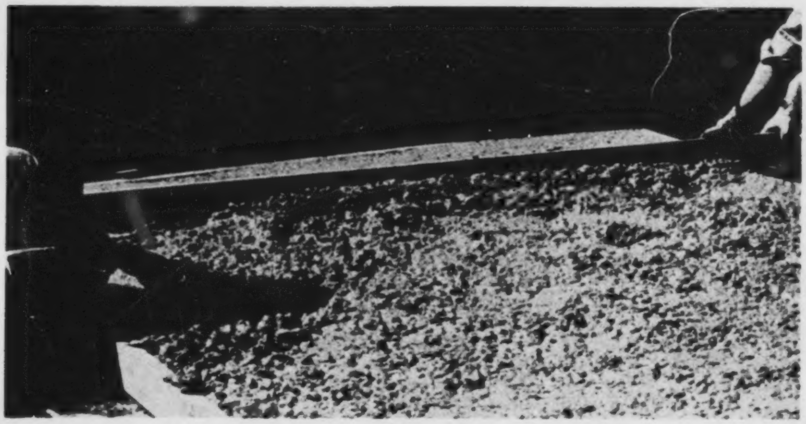
JOB SHEET #2

B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

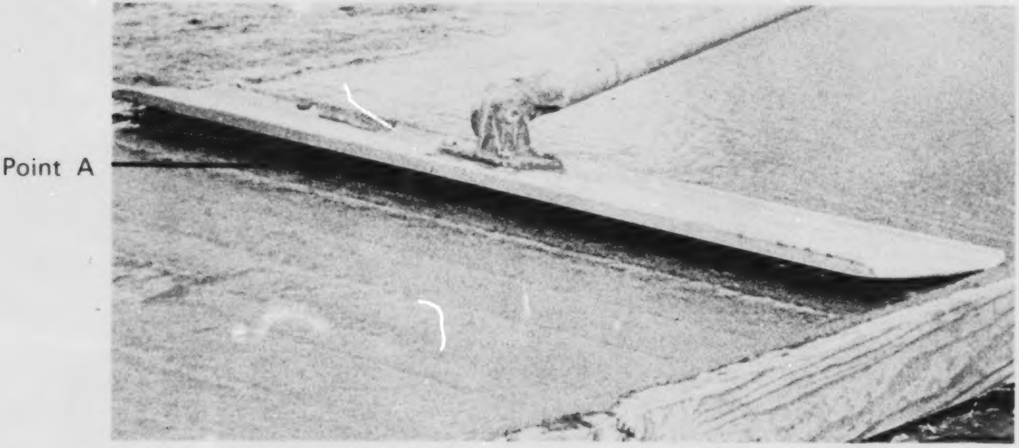
FIGURE 2



C. Bullfloat surface with a forward and backward movement across walk immediately after rodding

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

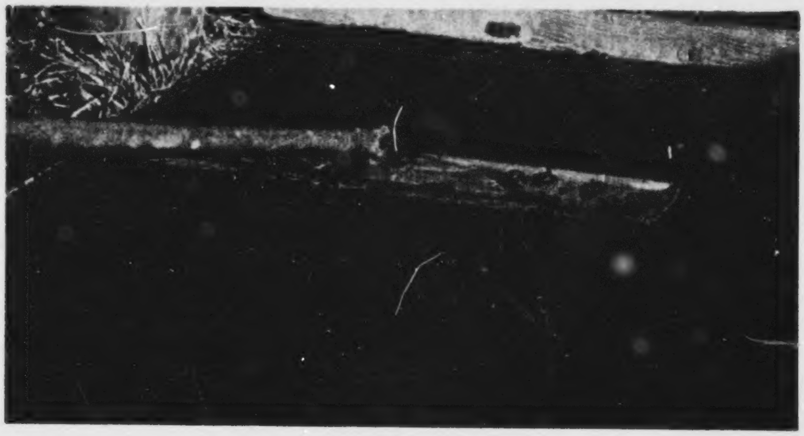
FIGURE 3



JOB SHEET #2

E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

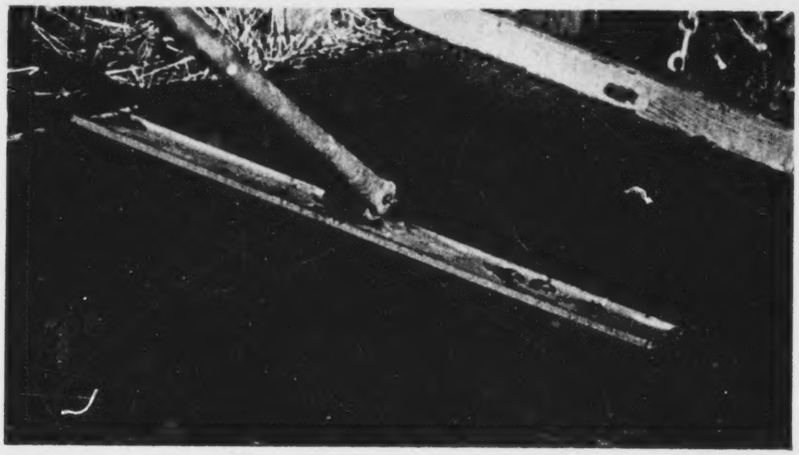
FIGURE 4



Point B

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



Point B

G. Overlap previous pass slightly and continue process until walk has been floated

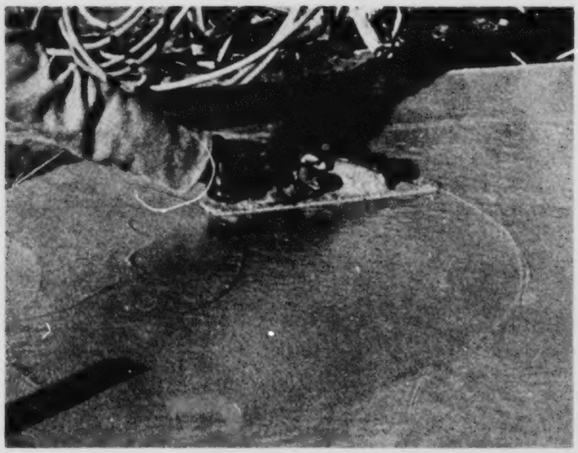
(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete.)

JOB SHEET #2

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 6

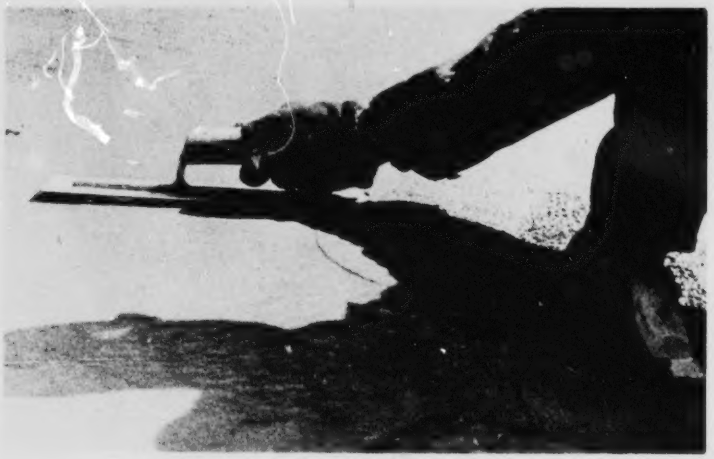


I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

J. Extend trowel at arm's length and move it in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 7)

FIGURE 7



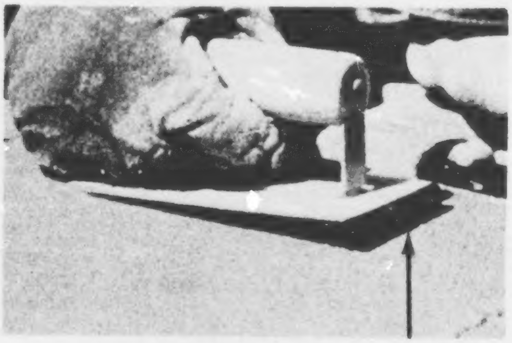
JOB SHEET #2

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

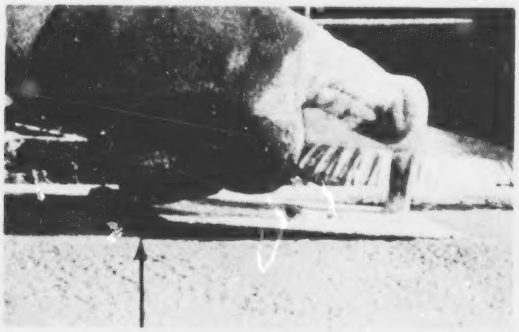
FIGURE 8



M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

(CAUTION: To avoid low places, do not place too much pressure on edger.)

FIGURE 9



JOB SHEET #2

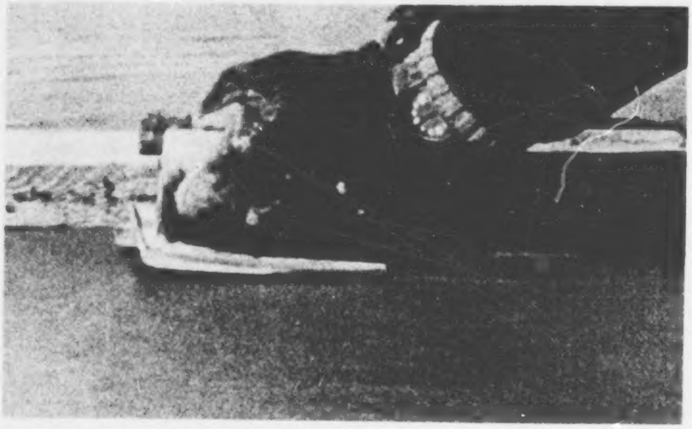
N. Continue this procedure until all edges are rounded and smooth

O. Edge all expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 10)

FIGURE 10



R. Reverse tool and pull back across the joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and chisel to make first cut; then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be obtained.)

T. Rerun edger and jointer again to smooth out joints and edges

U. Start finish troweling at point of first troweling or at hardest point of concrete

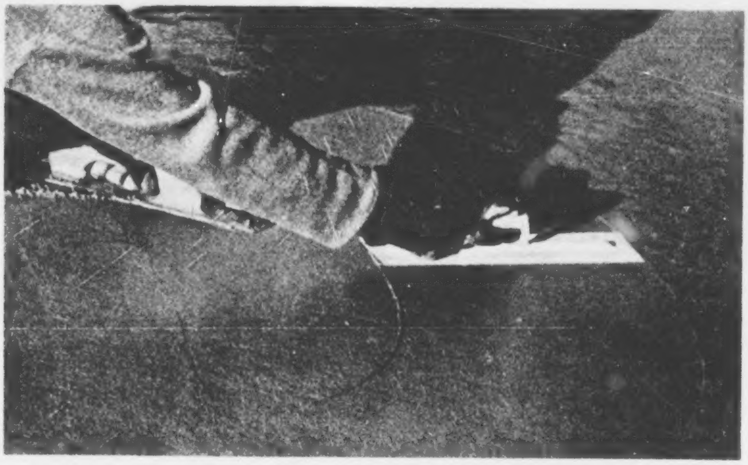
(NOTE: If rough swirl finish is specified, use float. For fine swirl, use trowel.)

V. Extend trowel at arm's length and move trowel in a wide semicircular fanlike motion, keeping trowel flat to surface

JOB SHEET #2

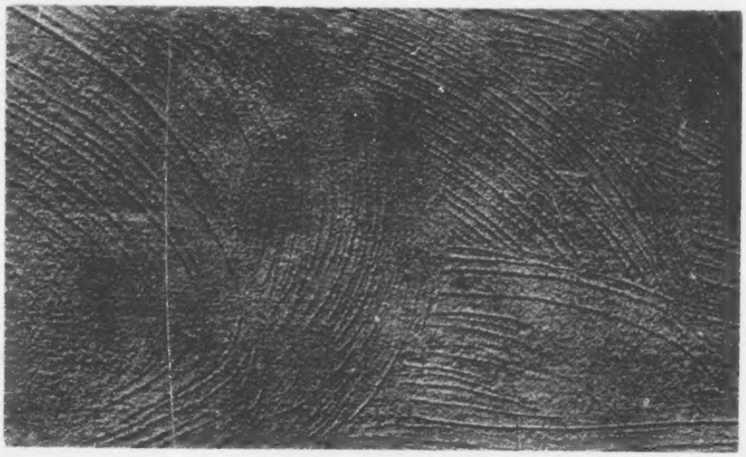
(NOTE: This will leave a fine, fuzzy, fanlike pattern. See Figure 11.)

FIGURE 11



W. Continue this process until entire walk is completed (Figure 12)

FIGURE 12



X. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Y. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #3--PLACE AND FINISH SIDEWALK WITH FINE BROOM FINISH

I. Tools and materials

  A. Tools

    1. Straightedge
    2. Bullfloat
    3. Hand float
    4. Finishing trowel
    5. Edger
    6. Jointer
    7. Push broom, fine
    8. Margin trowel
    9. Brush
    10. Sprayer

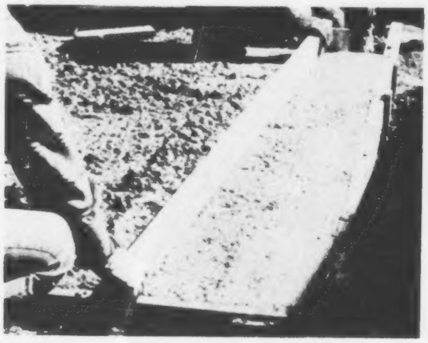
  B. Materials

    1. Concrete
    2. Bucket of water
    3. Curing agent

II. Procedure

  A. Place concrete at starting point (Figure 1)

FIGURE 1



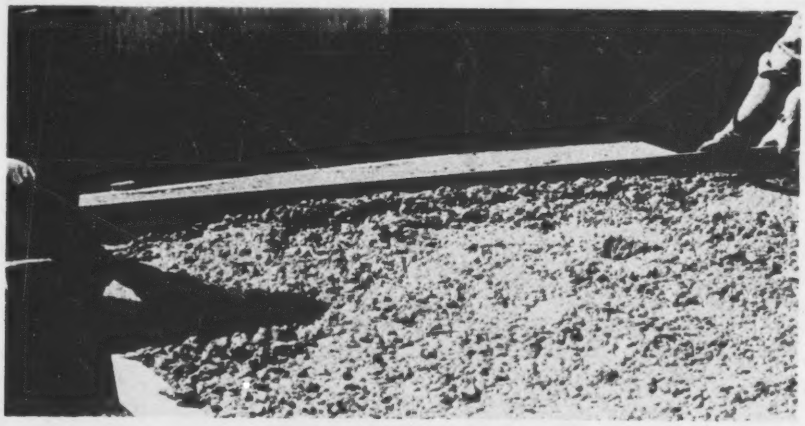
JOB SHEET #3

B. Use straightedge with sawlike motion and rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2

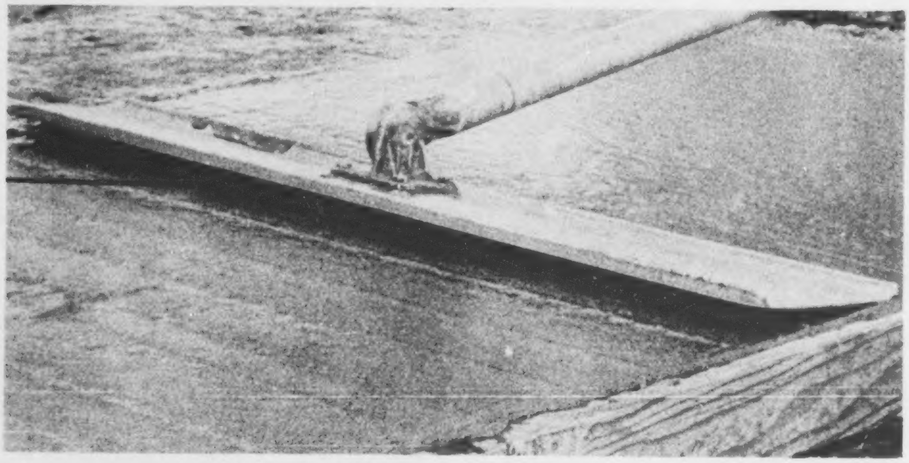


C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

FIGURE 3

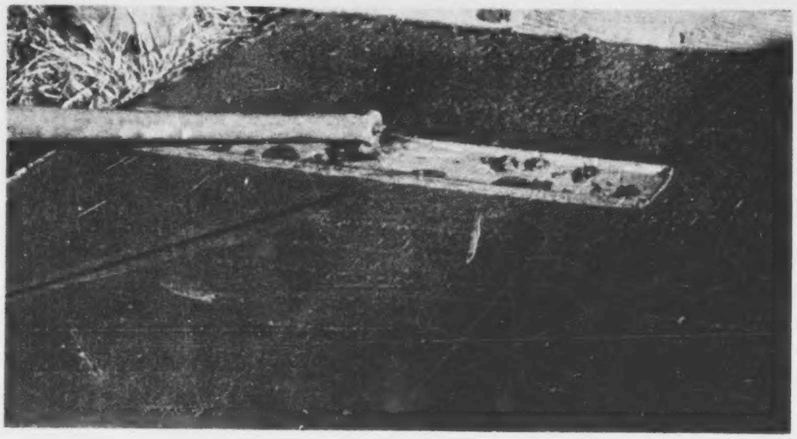


Point A

JOB SHEET #3

E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

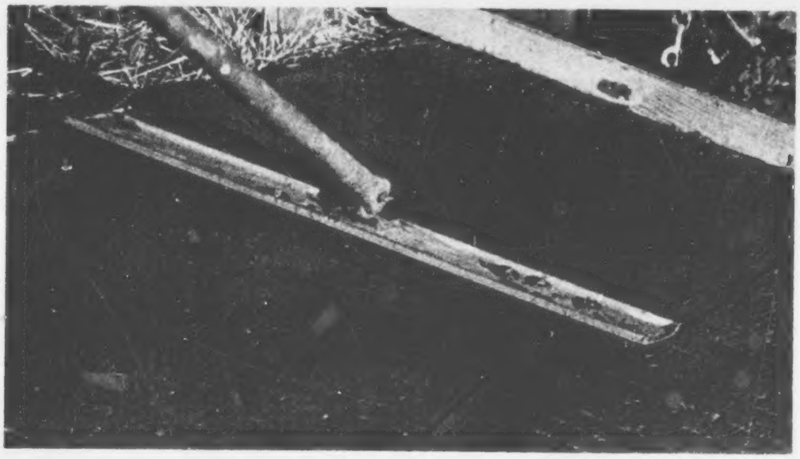
FIGURE 4



Point B

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



Point B

G. Overlap previous pass slightly and continue process until walk has been floated

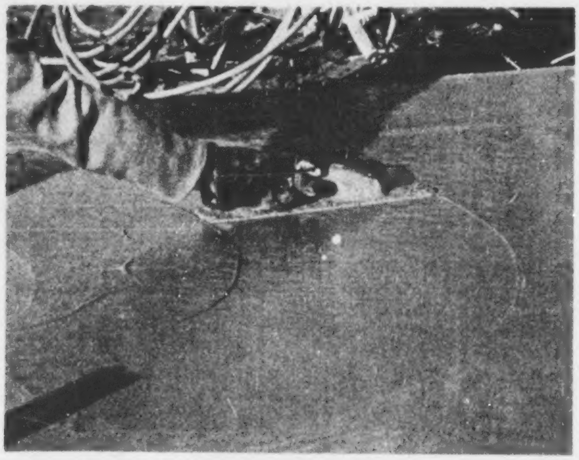
(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave. This is not usually so when using air-entrained concrete.)

JOB SHEET #3

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 6

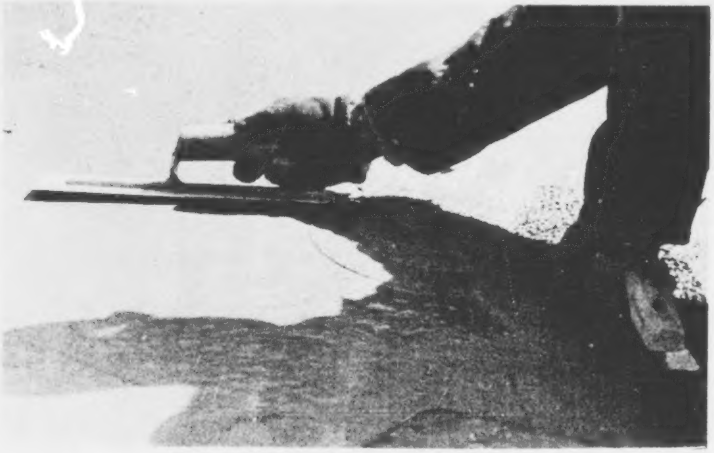


I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

J. Extend trowel at arm's length and move it in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 7)

FIGURE 7



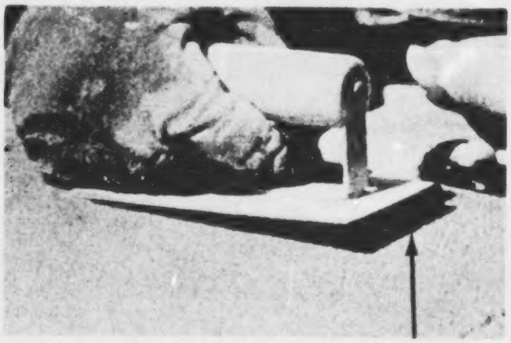
JOB SHEET #3

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

FIGURE 8

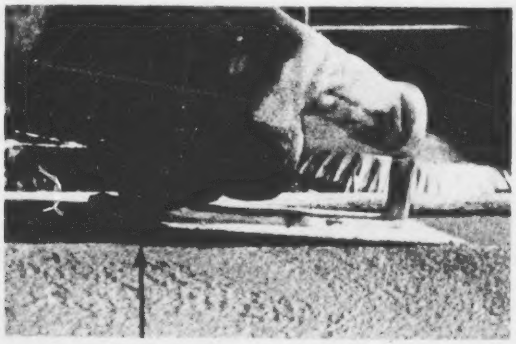


Point A

M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 9



Point B

JOB SHEET #3

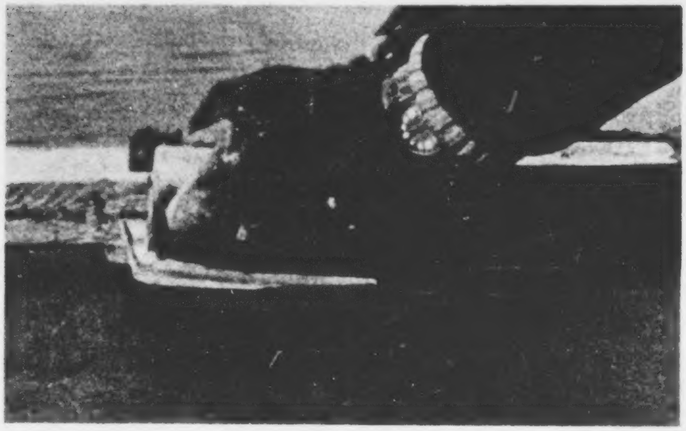
N. Continue this procedure until all edges are rounded and smooth

O. Edge all expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark location of all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 10)

FIGURE 10



R. Reverse tool and pull back across the joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and wide chisel to make first cut; then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be obtained.)

T. Extend trowel at arm's length and move trowel in a wide semicircular motion; slightly tilt trowel and continue until concrete is smooth

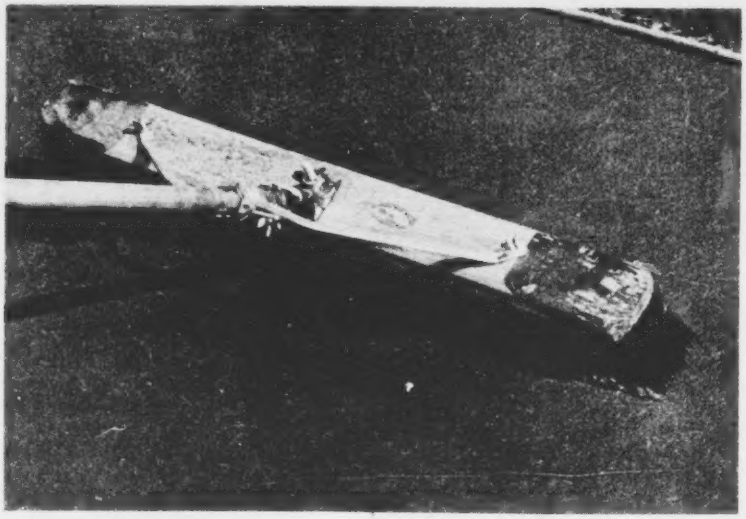
U. Continue this process until entire walk has been troweled

JOB SHEET #3

V. Start broom finish by placing broom across walk and pulling forward across walk (Figure 11)

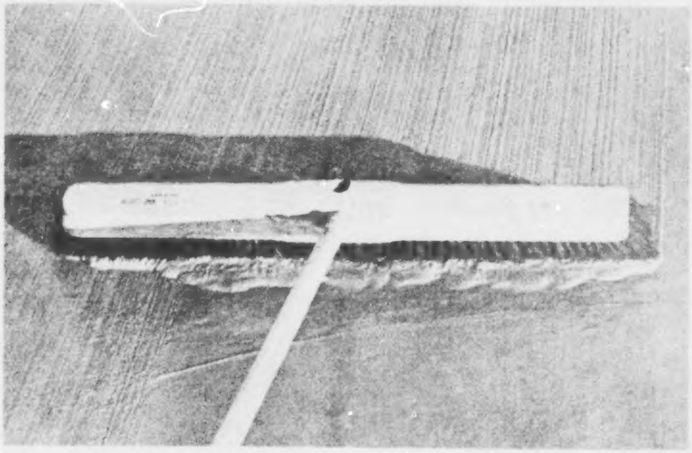
(NOTE: Broom finish pattern is usually specified to be at right angles with direction of travel; occasionally specifications may call for each block (between joints) to be broomed at right angles to each other.)

FIGURE 11



W. Swing broom back to starting edge and repeat pulling across slab, slightly lapping preceding pass (Figure 12)

FIGURE 12



JOB SHEET #3

X. Continue this procedure until entire walk has been broomed (Figure 13)

(NOTE: Sometimes specifications will call for edger and jointer marks to be left exposed, especially on broom finishes.)

FIGURE 13

Y. Rerun edger and jointer taking same precautions as to pressing too deep and picking up tools from surface

Z. Apply curing agent using sprayer with nozzle adjusted to a fine mist

AA. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #4--PLACE AND FINISH SIDEWALK WITH EXPOSED AGGREGATE FINISH

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float
4. Finishing trowel
5. Edger
6. Jointer
7. Push broom, nylon bristle
8. Water hose
9. Margin trowel
10. Shovel
11. Brush
12. Sprayers, 2

B. Materials

1. Concrete
2. Water and bucket
3. Aggregate
4. Surface retarder
5. Curing agent

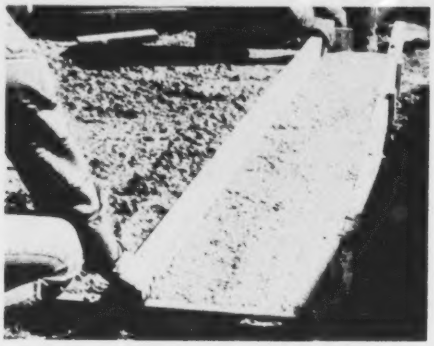
(NOTE: For exposed aggregate jobs, a special type aggregate is usually specified.)

JOB SHEET #4

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

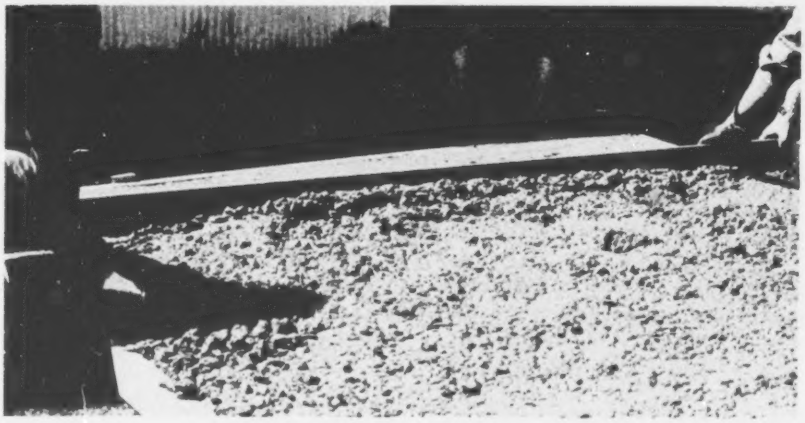


B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2



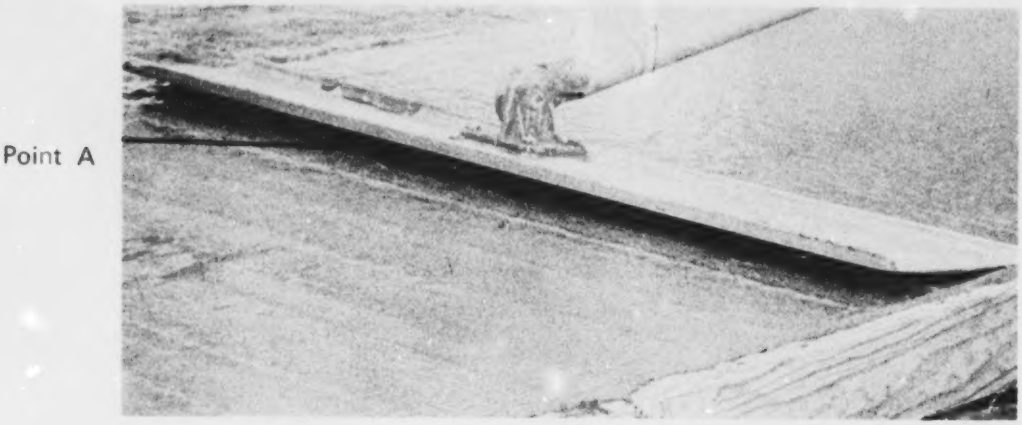
JOB SHEET #4

C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

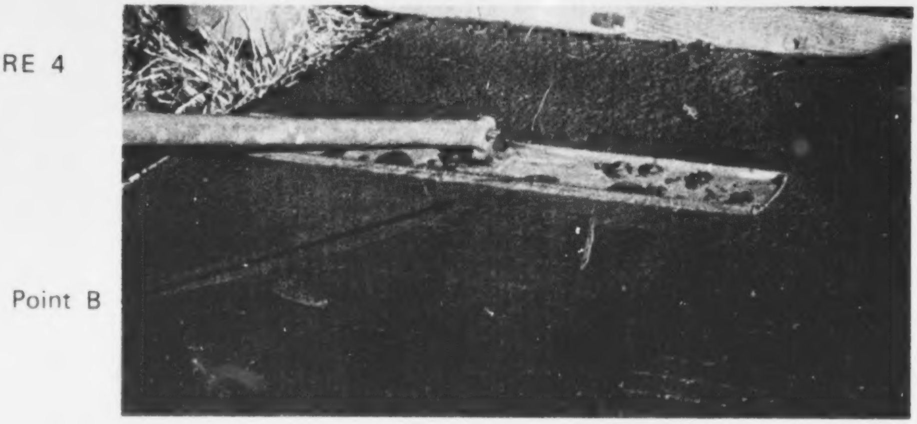
D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

FIGURE 3



E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

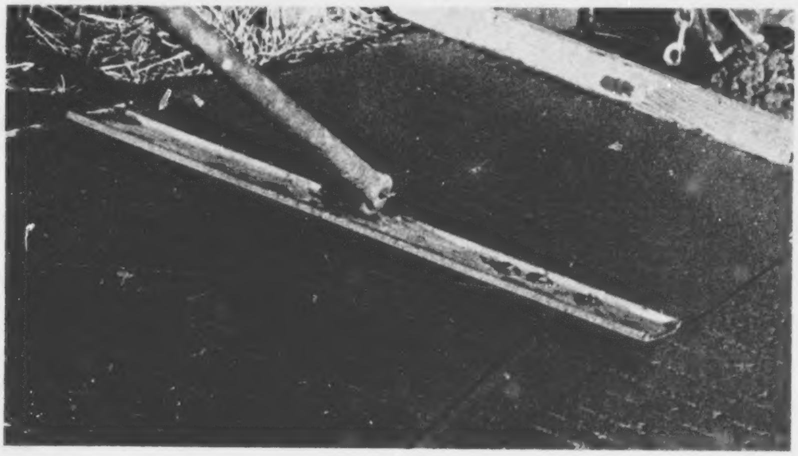
FIGURE 4



JOB SHEET #4

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



Point B

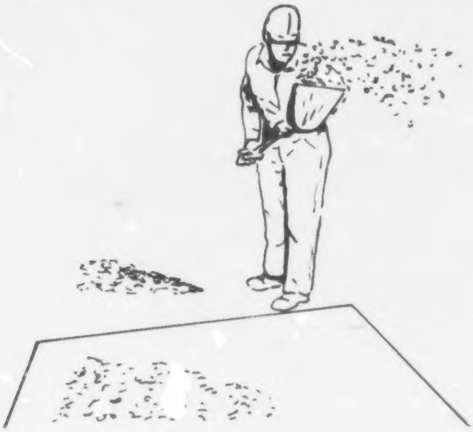
G. Overlap previous pass slightly and continue process until walk has been floated

(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete or when applying aggregate for exposed aggregate finish.)

H. Use shovel and hands to spread aggregate uniformly over surface (Figure 6)

(NOTE: Sometimes and in some areas special premixed concrete mixtures are specified. Therefore, it is not necessary to seed aggregate on the surface.)

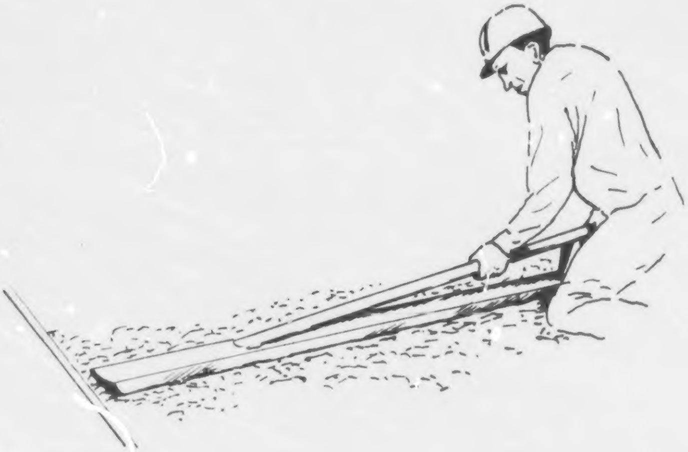
FIGURE 6



JOB SHEET #4

I. Embed aggregate by tapping down with wood float, darby, bullfloat, and sometimes a jitterbug or rollerbug (Figure 7)

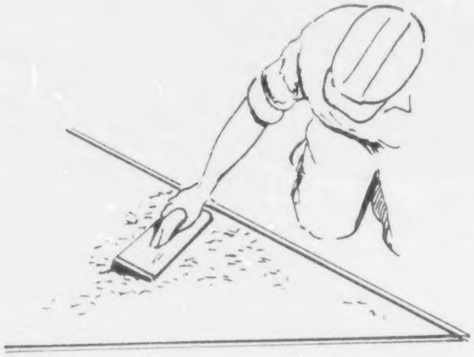
FIGURE 7



J. Close up surface, using bullfloat and handfloat until surface looks similar to normal concrete slab (Figure 8

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 8



K. Apply surface retarder using sprayer with nozzle adjusted to a medium spray so concrete will not set too fast

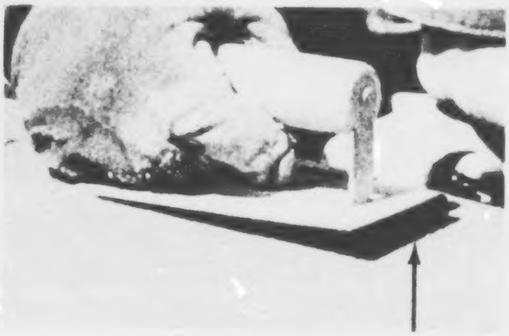
JOB SHEET #4

L. Run edger and jointer immediately after surface is closed up

M. Tilt up point A of edger, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 9)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

FIGURE 9

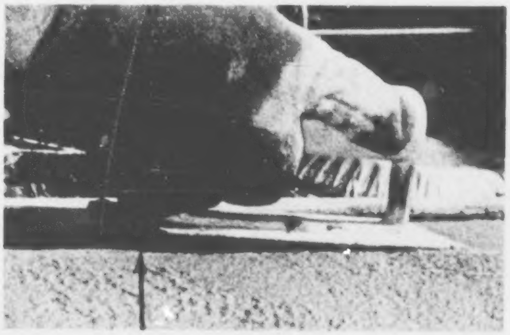


Point A

N. Extend edger at arm's length and draw backward with point B of edger slightly tilted up (Figure 10)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 10



Point B

JOB SHEET #4

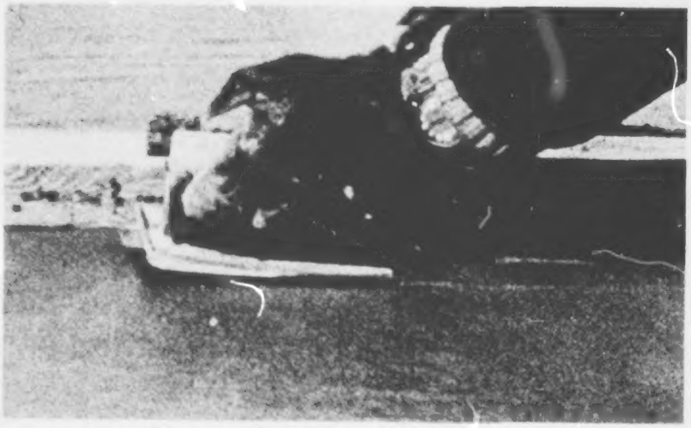
O. Continue this procedure until all edges are rounded and smooth

P. Edge all expansion joints, following same procedure and taking all precautions

Q. Use rule or tape to measure and mark location of all joints as specified

R. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 11)

FIGURE 11



S. Reverse tool and pull back across the joint after running jointer across walk

(NOTE: This will give a smooth finish.)

T. Continue using straightedge and jointer until all joints have been cut

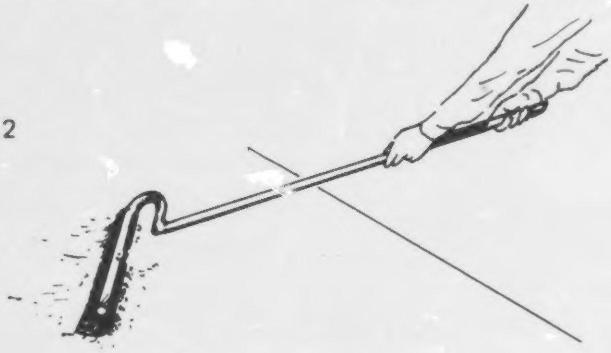
(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and chisel to make first cut; then use jointer to work and smooth joint. Timing is a very important factor at this point. Walk should be hard enough to hold a person with little or no depression.)

JOB SHEET #4

U. Use push broom or special broom for exposed aggregate and lightly brush slab, removing excess fines from the surface (Figure 12)

(NOTE: Before continuing with process be sure concrete is solid enough that no depression will be made and aggregate will not be dislodged with washing and brooming operations. Depth of stone to be exposed depends on size of aggregate, but this is usually specified.)

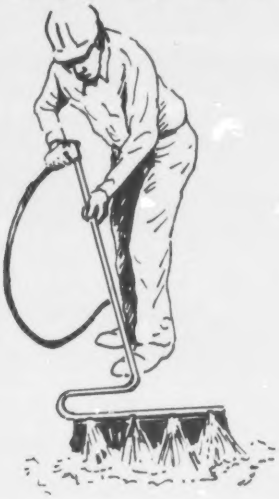
FIGURE 12



V. Use push broom and water to brush and wash surface of walk until there is no noticeable cement film left on aggregate (Figure 13)

(NOTE: After walks have been cured and hardened sufficiently, it may be necessary to clean them by using an acid etch or by sandblasting.)

FIGURE 13



W. Apply curing agent using sprayer with nozzle adjusted to a fine mist

X. Use margin trowel to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #5--PLACE AND FINISH SIDEWALK WITH SWIRL FINISH USING NONSKID MATERIAL

I. Tools and materials

   A. Tools

      1. Straightedge
      2. Bullfloat
      3. Hand float
      4. Finishing trowel
      5. Edger
      6. Jointer
      7. Margin trowel
      8. Tape or rule
      9. Brush
      10. Sprayer

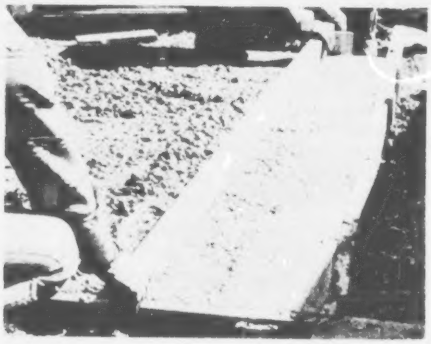
   B. Materials

      1. Concrete
      2. Abrasive grits
      3. Bucket of water
      4. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1



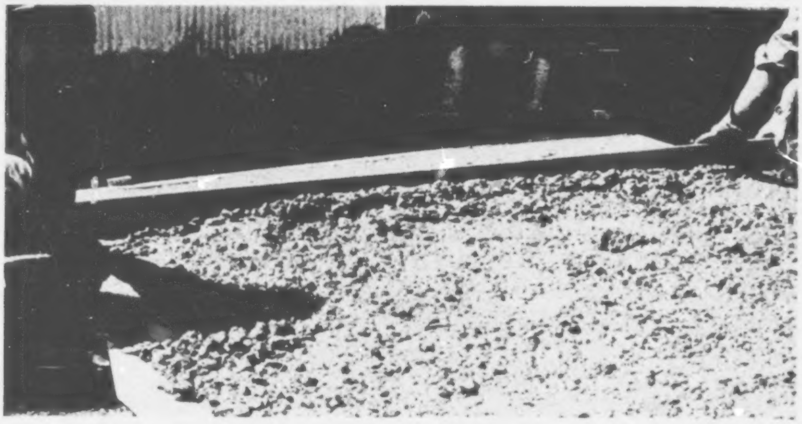
JOB SHEET #5

B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2

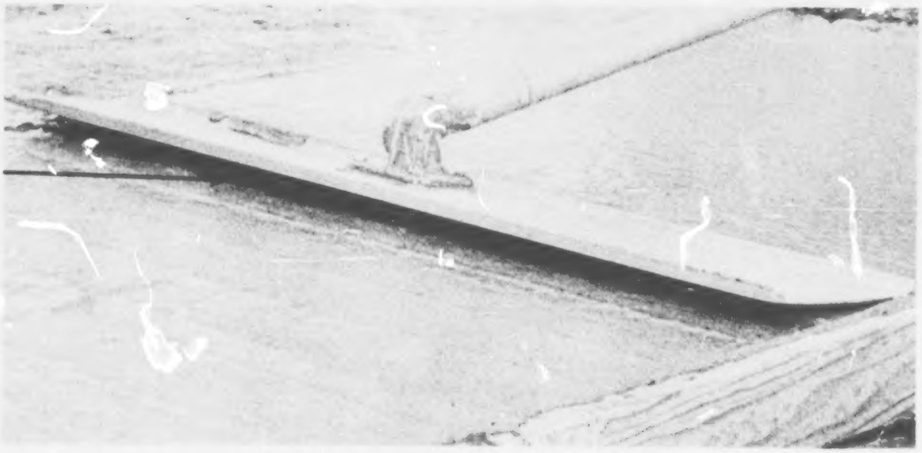


C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

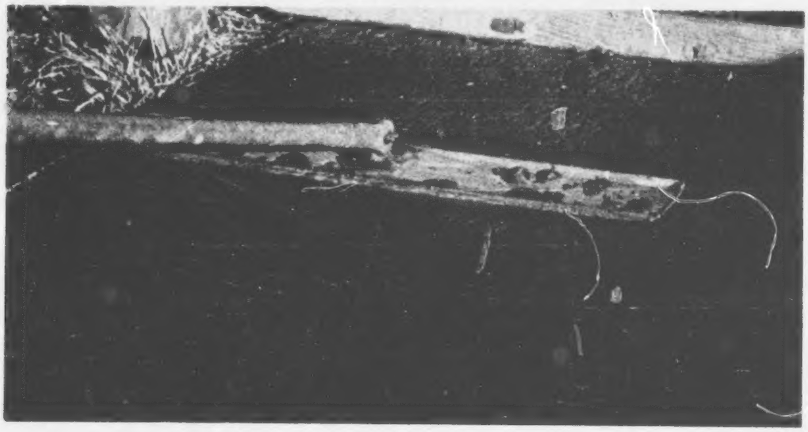
FIGURE 3



JOB SHEET #5

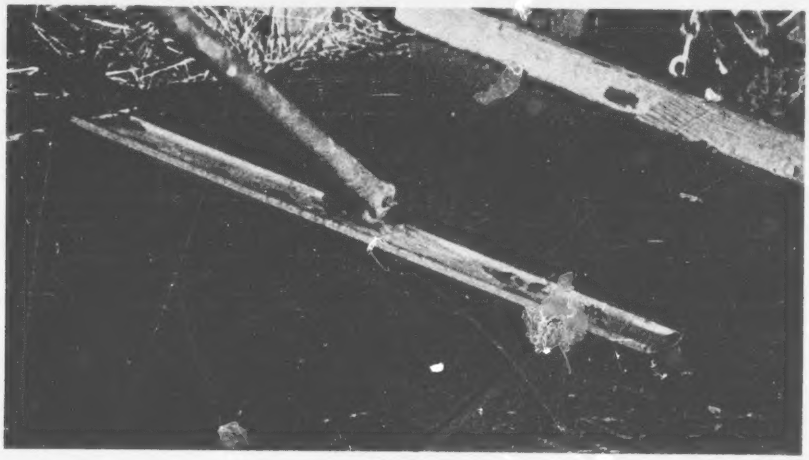
E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

FIGURE 4



F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



G. Overlap previous pass slightly and continue process until walk has been floated

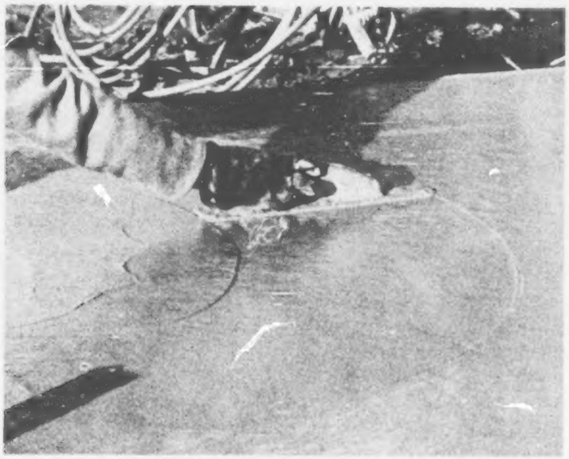
(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete.)

JOB SHEET #5

H. Float concrete at start of pour with float at arm's length, moving in a wide semicircular motion until surface is smooth and free of high and low places; keep float flat to surface (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 6

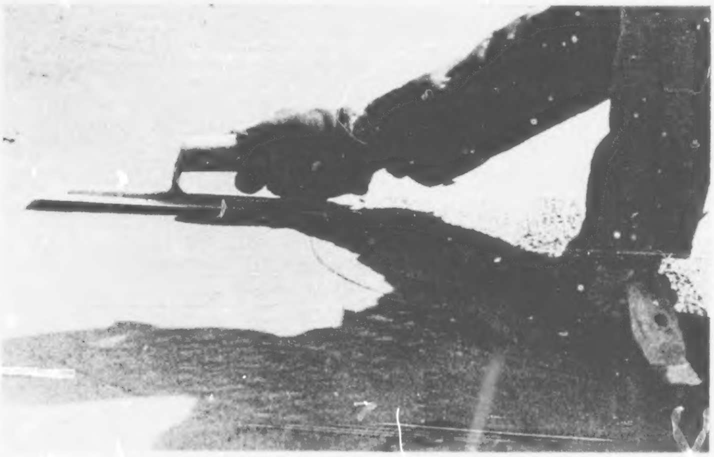


I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step is done immediately after floating an area.)

J. Extend trowel at arm's length and move trowel in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 7)

FIGURE 7



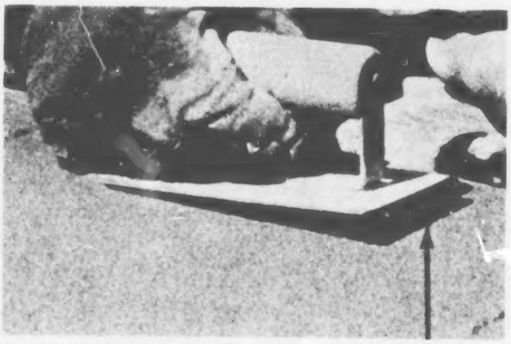
JOB SHEET #5

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

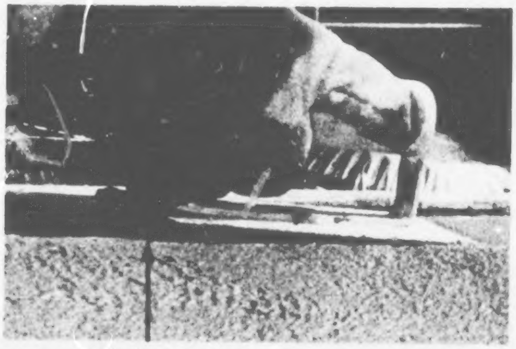
FIGURE 8



M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 9



N. Continue this procedure until all edges are rounded and smooth

JOB SHEET #5

O. Edge expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark location of all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 10)

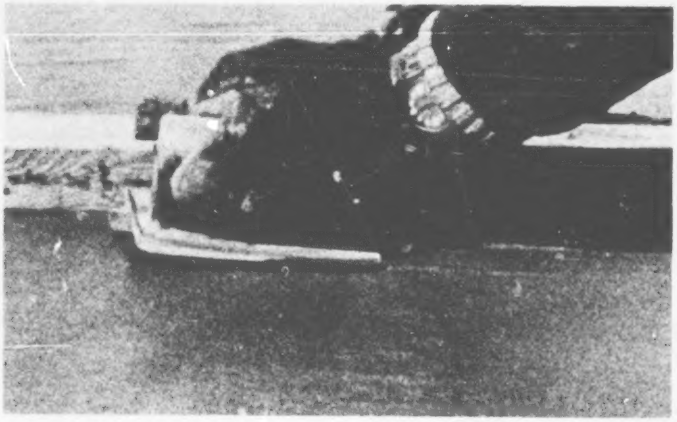


FIGURE 10

R. Reverse tool and pull back across joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to the point where jointer will not make depression, it may be necessary to use hatchet or hammer and chisel to make first cut; then use jointer to work and smooth joint. Allow enough time after jointing before applying abrasive material. Concrete should be hard enough so that grits do not settle too deeply into the surface.)

T. Run edger and jointer again to smooth out edges and joints

U. Apply grits by hand, sprinkling uniformly over surface

(NOTE: Use manufacturer's specifications as to application and amount of material.)

(CAUTION: Embed grits properly so that they bond but still remain at the surface.)

V. Use finishing trowel at arm's length and move trowel in a wide semicircular fanlike motion with trowel relatively flat to surface

(NOTE: This will produce a fine, fuzzy, fanlike pattern.)

JOB SHEET #5

W. Continue this process until entire walk is completed (Figure 11)

FIGURE 11

X. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Y. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #6--PLACE AND FINISH SIDEWALK WITH ROCK SALT FINISH

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float
4. Finishing trowel
5. Edger
6. Jointer
7. Margin trowel
8. Tape or rule
9. Brush
10. Sprayer

B. Materials

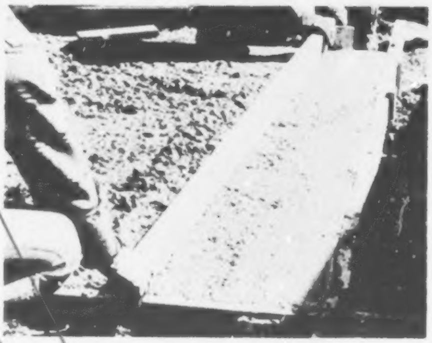
1. Concrete
2. Rock salt
3. Bucket of water
4. Curing agent

JOB SHEET #6

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

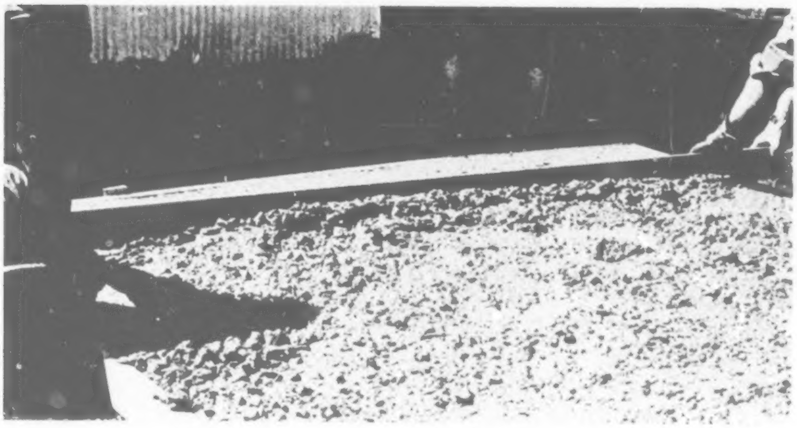


B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE. Straightedge must be from one to two feet longer than widest distance to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2



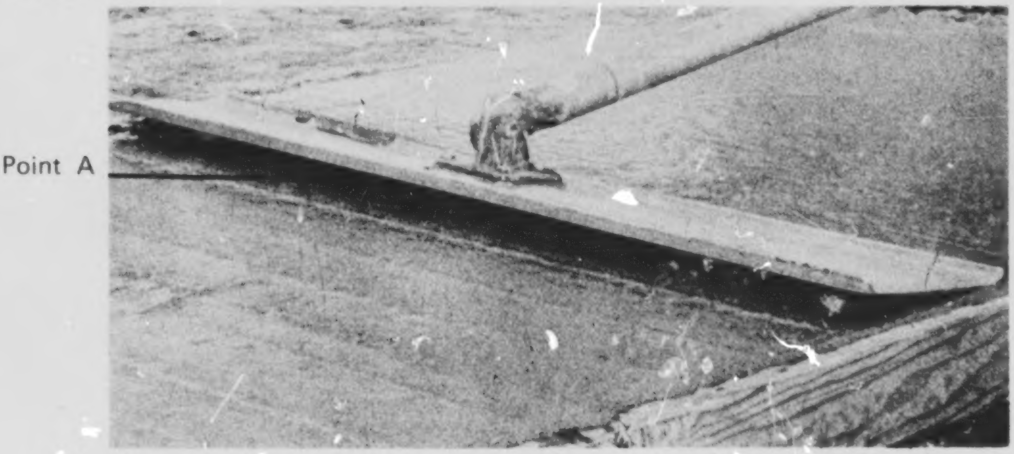
JOB SHEET #6

C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

FIGURE 3



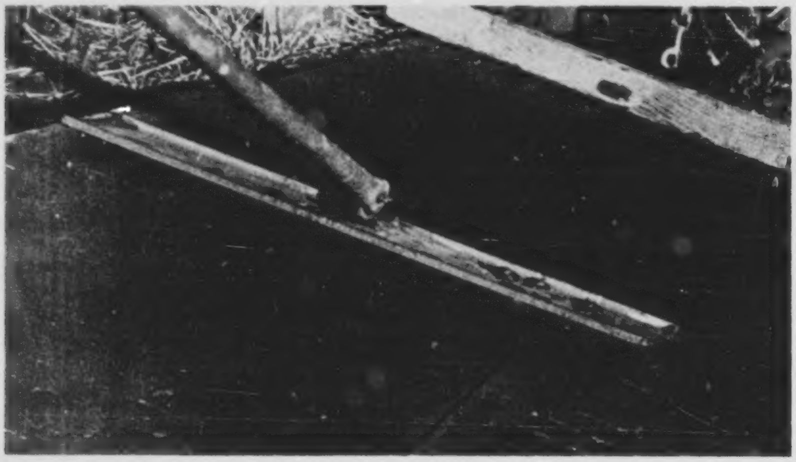
E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

FIGURE 4

JOB SHEET #6

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5

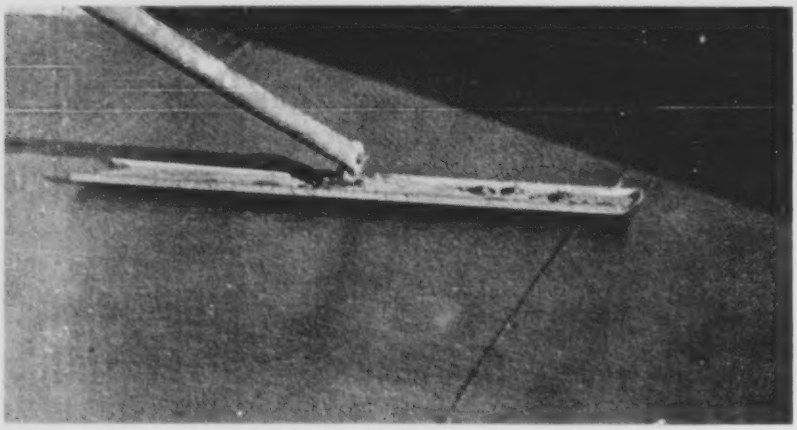


Point B

G. Overlap previous pass slightly and continue process until walk has been floated (Figure 6)

(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete.)

FIGURE 6

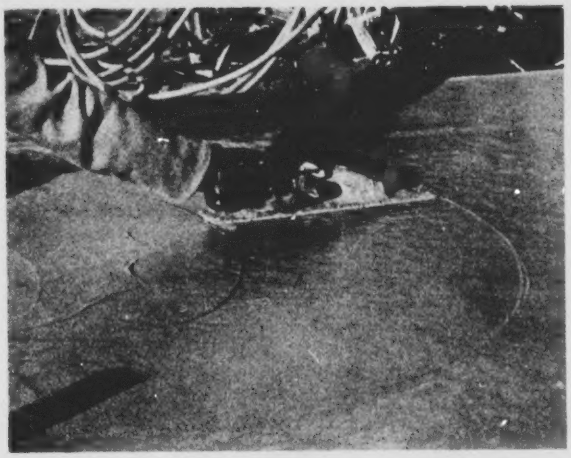


JOB SHEET #6

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 7)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 7

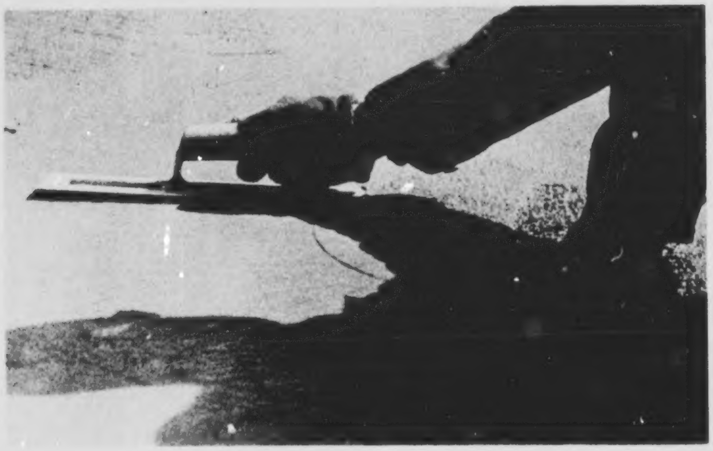


I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

J. Extend trowel at arm's length and move trowel in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 8)

FIGURE 8



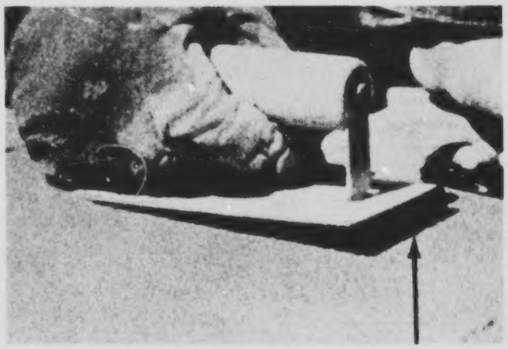
JOB SHEET #6

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 9)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

FIGURE 9

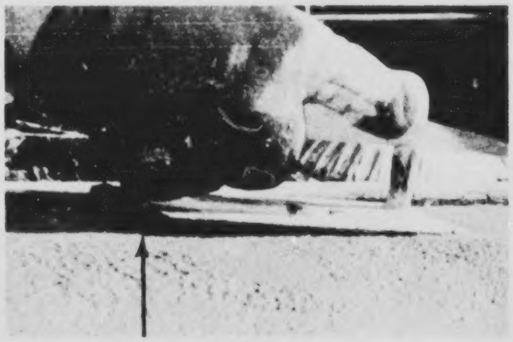


Point A

M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 10)

(CAUTION To avoid low places do not place too much pressure on edger.)

FIGURE 10



Point B

JOB SHEET #6

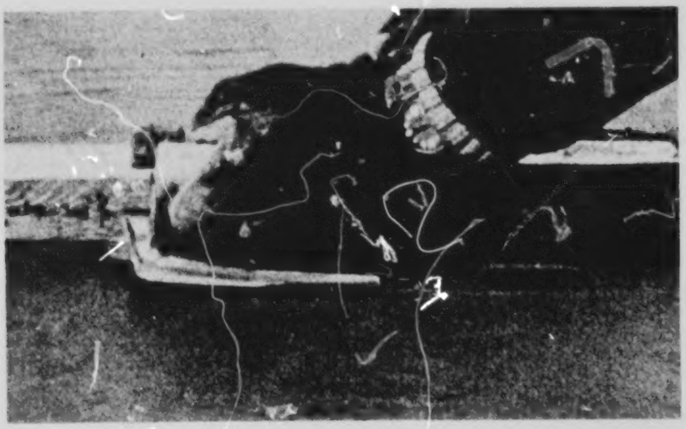
N. Continue this procedure until all edges are rounded and smooth

O. Edge expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark location of all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 11)

FIGURE 11



R. Reverse tool and pull back across joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to the point where jointer will not make depression, it may be necessary to use hatchet or hammer and chisel to make first cut. Then use jointer to work and smooth joint. Allow enough time after jointing before applying rock salt. Surface should be hard enough so that when salt is troweled in it will be at surface of walk.)

T. Run edger and jointer again to smooth out edges and joints

U. Apply salt by hand, sprinkling uniformly over surface

(CAUTION: Embed salt so that it is flush to the surface of walk.)

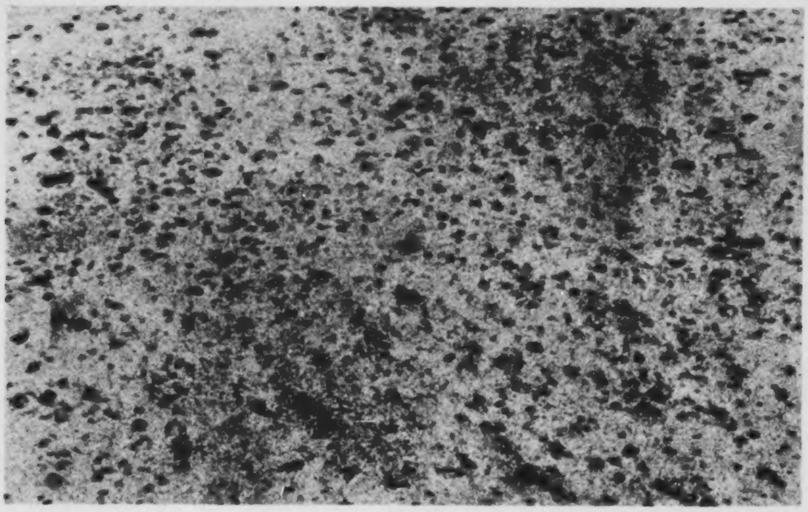
V. Use finishing trowel at arm's length and move trowel in a wide semicircular motion with trowel relatively flat to surface

(NOTE: At this time it may be necessary to rerun edges and joints. If so, trowel out edger and jointer marks, leaving surface relatively smooth.)

JOB SHEET #6

W. Continue this process until entire walk is completed (Figure 12)

FIGURE 12



X. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Y. Use margin trowel, brush, and water to clean tools and equipment

(NOTE: Use water and broom to wash out all salt. This is done the following day or later after concrete has hardened sufficiently.)

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #7--PLACE AND FINISH SIDEWALK WITH TRAVERTINE OR KEYSTONE FINISH

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float
4. Finishing trowel
5. Edger
6. Jointer
7. Margin trowel
8. Tape or rule
9. Brush
10. Bucket
11. Sprayer

B. Materials

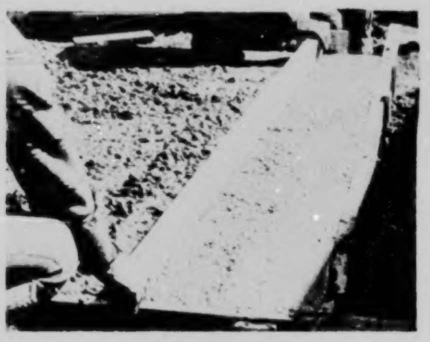
1. Concrete
2. Mud
3. Color pigment (sometimes)
4. Curing agent

JOB SHEET #7

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

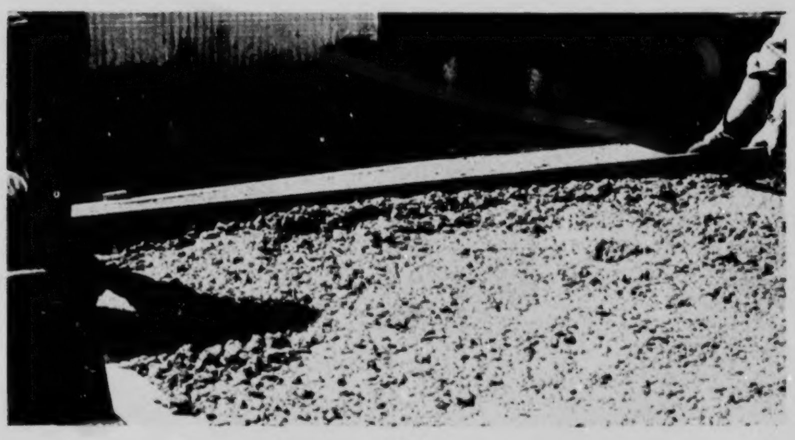


B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2



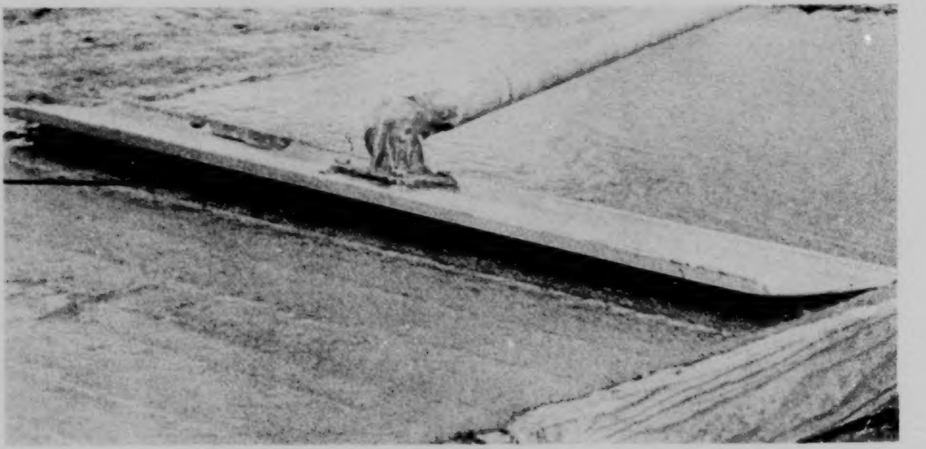
JOB SHEET #7

C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

FIGURE 3



Point A

E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

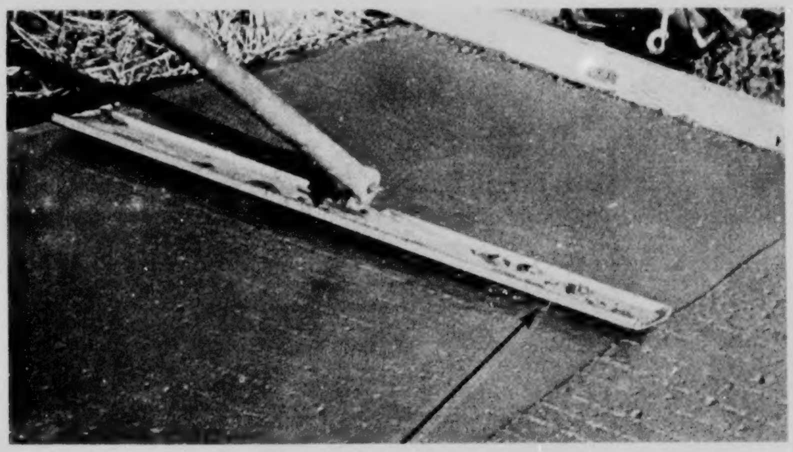
FIGURE 4

Point B

JOB SHEET #7

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5

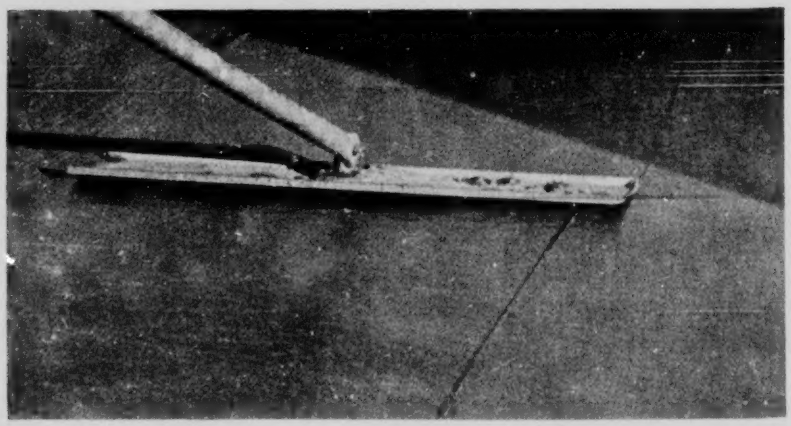


Point B

G. Overlap previous pass slightly and continue process until walk has been floated (Figure 6)

(CAUTION. Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete.)

FIGURE 6

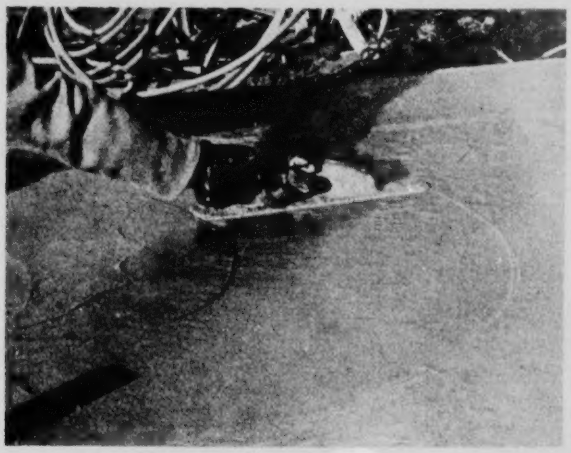


JOB SHEET #7

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 7)

(CAUTION: Keep float at right angles to forms when working along edge of forms.)

FIGURE 7

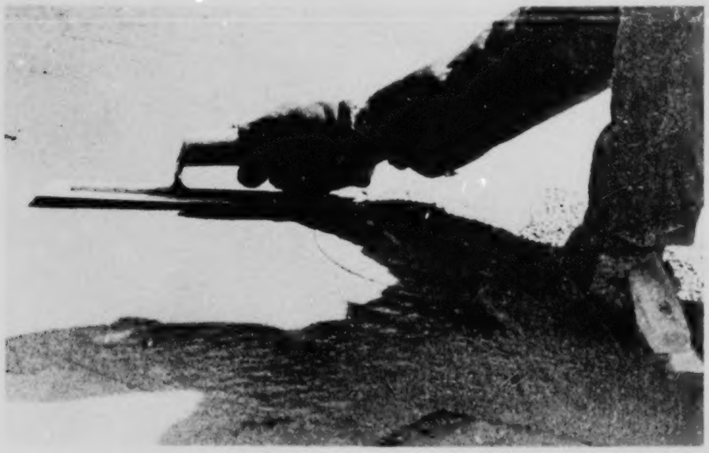


I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

J. Extend trowel at arm's length and move trowel in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 8)

FIGURE 8



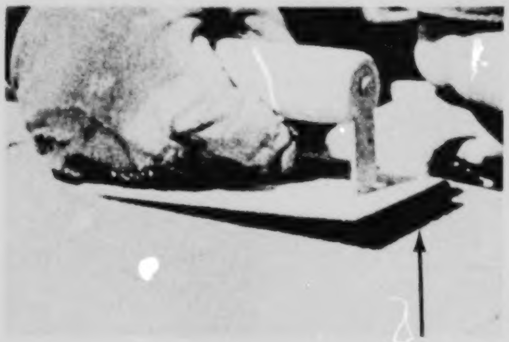
JOB SHEET #7

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 9)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

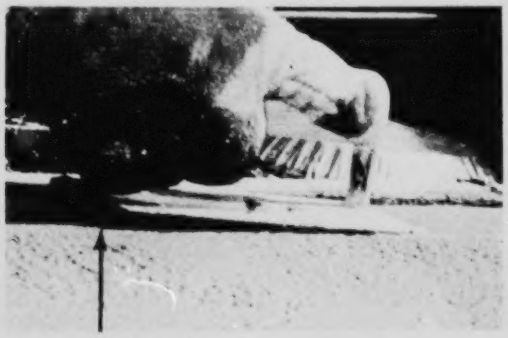
FIGURE 9



M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 10)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 10



N. Continue this procedure until all edges are rounded and smooth

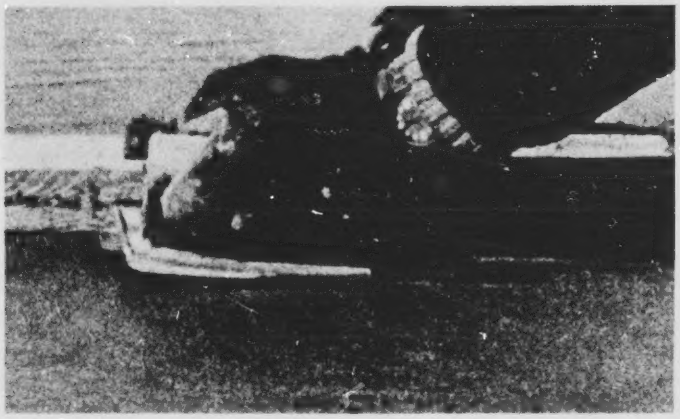
JOB SHEET #7

O. Edge all expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark location of all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 11)

FIGURE 11



R. Reverse tool and pull back across the joint after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to the point where jointer will not make depression, it may be necessary to use hatchet or hammer and chisel to make first cut. Then use jointer to work and smooth joint. It may be necessary for a time period to elapse before applying the finish. Sometimes a color pigment is used in mud.)

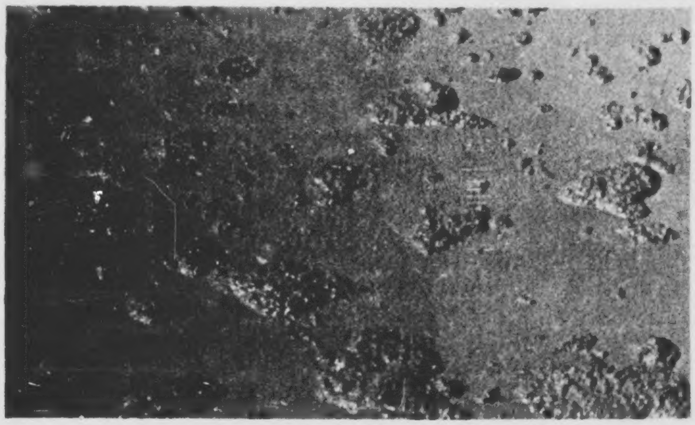
T. Use brush and dash mud in a splotchy manner

JOB SHEET #7

U. Allow coating to harden slightly and then trowel surface with trowel flat to surface; flatten ridges and spread mud (Figure 12)

(NOTE: As a result of finishing process the surface will be smooth on the high areas and coarse in the depressed areas.)

FIGURE 12



V. Run edger and jointer again to smooth out edges and joints

W. Retrowel lightly to work out any edger or jointer marks left by tools

X. Continue these steps until entire walk is finished (Figure 13)

FIGURE 13

Y. Apply curing agent using sprayer with nozzle adjusted to a fine mist

Z. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #8--PLACE AND FINISH SIDEWALK WITH GEOMETRIC FINISH

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float
4. Finishing trowel
5. Edger
6. Jointer
7. Margin trowel
8. Designing tool
9. Brush
10. Sprayer

B. Materials

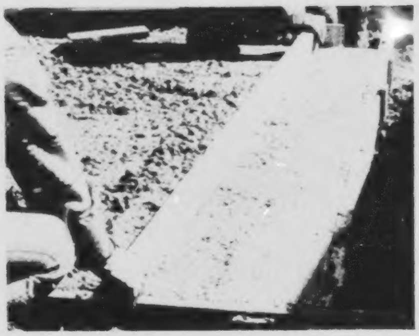
1. Concrete
2. Bucket of water
3. Curing agent

JOB SHEET #8

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1

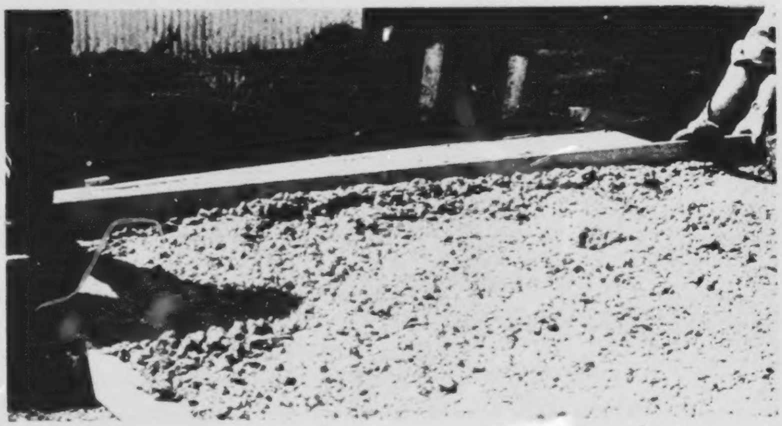


B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

FIGURE 2



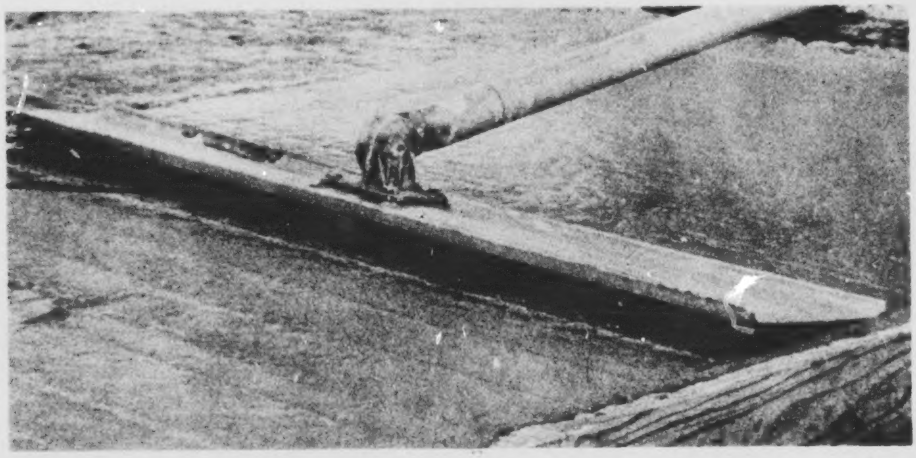
JOB SHEET #8

C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 3)

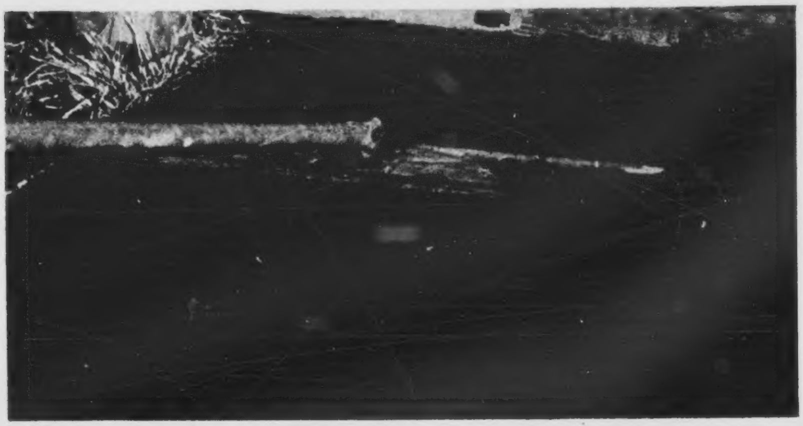
FIGURE 3



Point A

E. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 4)

FIGURE 4

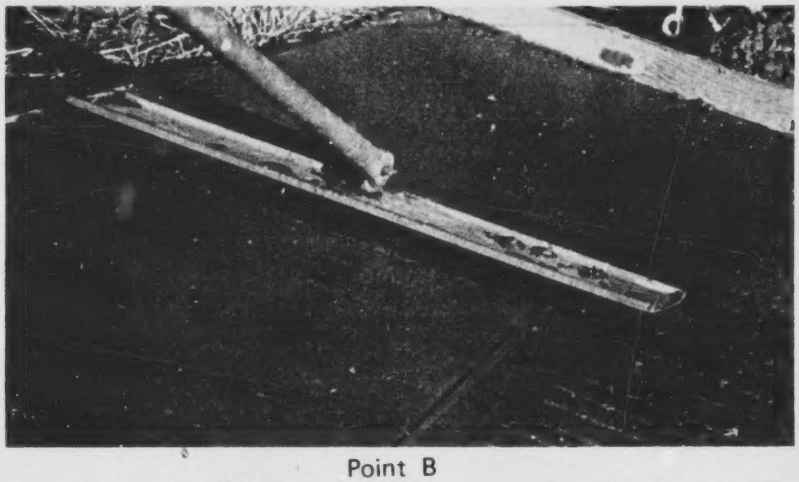


Point B

JOB SHEET #8

F. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 5)

FIGURE 5



Point B

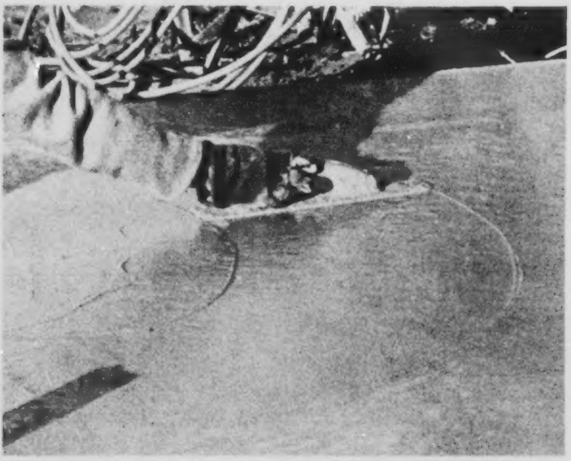
G. Overlap previous pass slightly and continue process until walk has been floated

(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave; this is not usually so when using air-entrained concrete.)

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 6)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 6



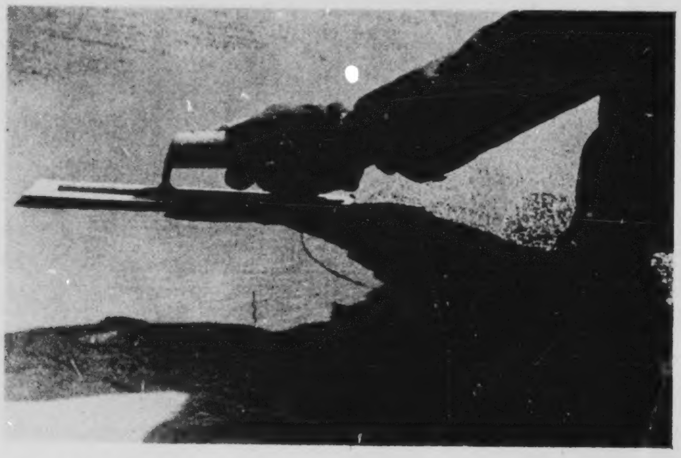
JOB SHEET #8

I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

J. Extend trowel at arm's length and move trowel in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 7)

FIGURE 7

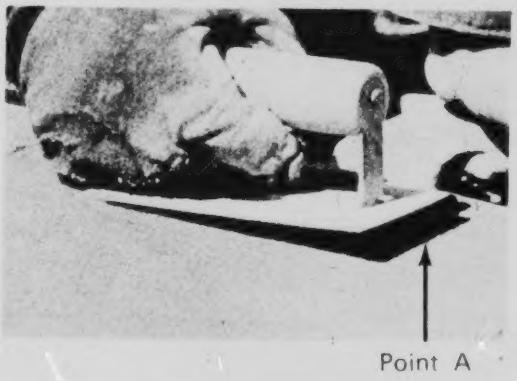


K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 8)

(CAUTION. To avoid picking up surface of concrete do not remove edger from concrete surface unless edger is in motion.)

FIGURE 8

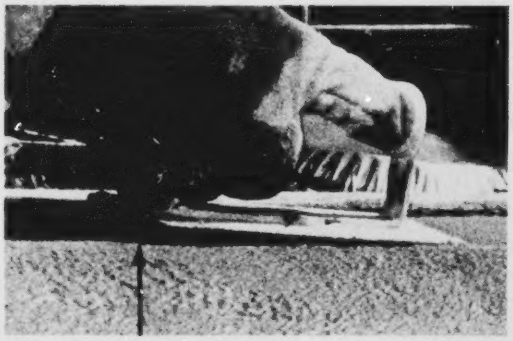


JOB SHEET #8

M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 9)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 9



Point B

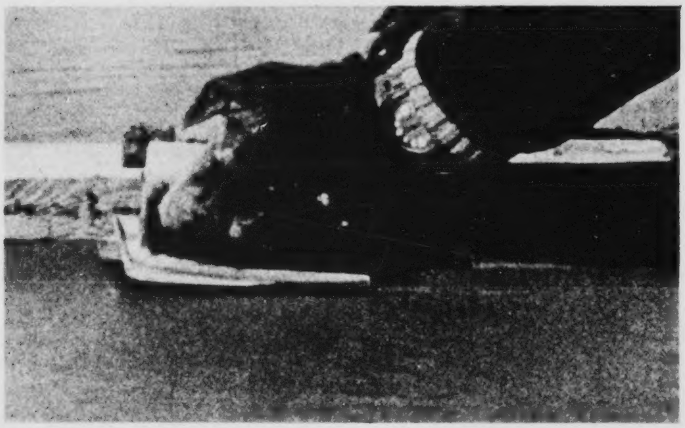
N. Continue this procedure until all edges are rounded and smooth

O. Edge all expansion joints, following edging procedures and taking all precautions

P. Use rule or tape to measure and mark all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 10)

FIGURE 10



JOB SHEET #8

R. Reverse tool and pull back across the joint after running joint across walk

(NOTE: This will give a smooth finish.)

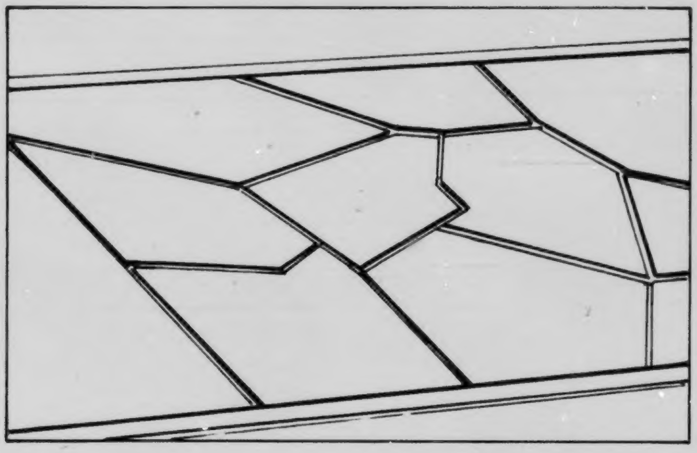
S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and chisel to make first cut. Then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be obtained. A wide variety of geometric type finishes may be obtained, such as stone, brick, tile, patterns using stamping tools, leaf patterns, and circle patterns cut with different sizes of cans.

T. Use jointer to make flagstone pattern and cut joints at random by applying slight pressure to back of tool (Figure 11)

(NOTE: Do not make patterns too large; work them so that they will resemble natural flagstone.)

FIGURE 11



U. Reverse tool and draw back across joint, after running jointer across walk

(NOTE: This will give a smooth finish.)

V. Continue this procedure until all joints have been cut

W. Retrowel walk in order to work out jointer marks

(NOTE: This step should be done after cutting joints.)

X. Rerun edges and joints by using same methods as in previous steps

JOB SHEET #8

Y. Retrowel surface and work out all jointer and edger marks by troweling as in previous steps

Z. Continue this process until walk is completed (Figure 12)

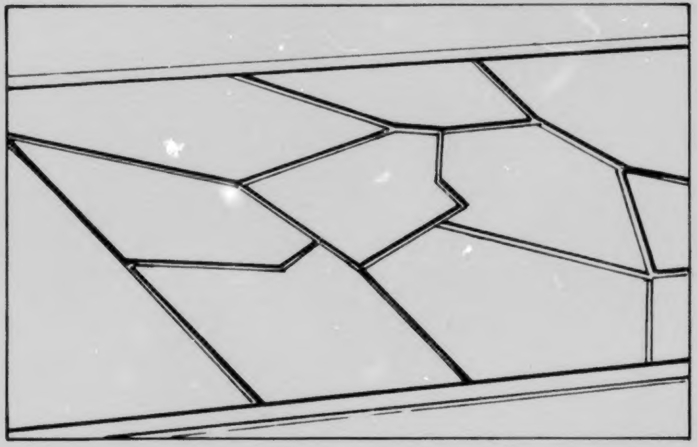


FIGURE 12

AA. Apply curing agent using sprayer with nozzle adjusted to a fine mist

BB. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #9--PLACE AND FINISH SIDEWALK WITH FINE SWIRL FINISH USING READY-MIX COLOR

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand floats
4. Finishing trowel
5. Edger
6. Jointer
7. Margin trowel
8. Sprayer
9. Brush

B. Materials

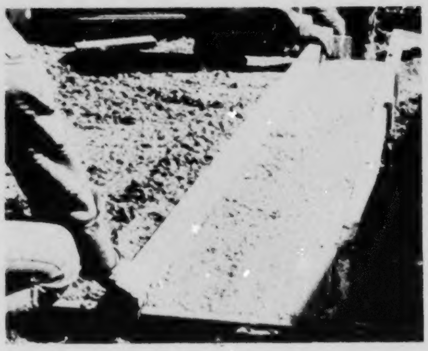
1. Concrete
2. Curing agent
3. Water

JOB SHEET #9

II. Procedure

A. Place concrete at starting point (Figure 1)

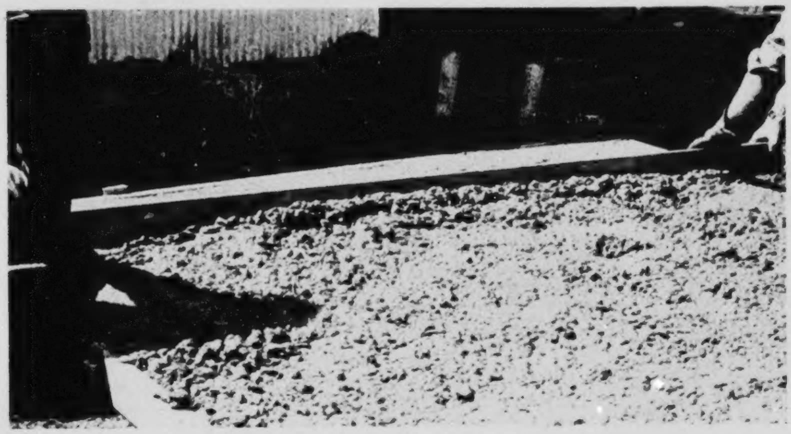
FIGURE 1



B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

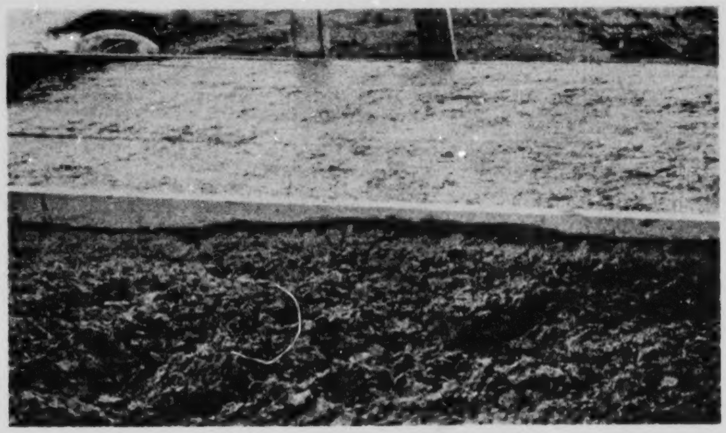
FIGURE 2



JOB SHEET #9

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes. See Figure 3.)

FIGURE 3



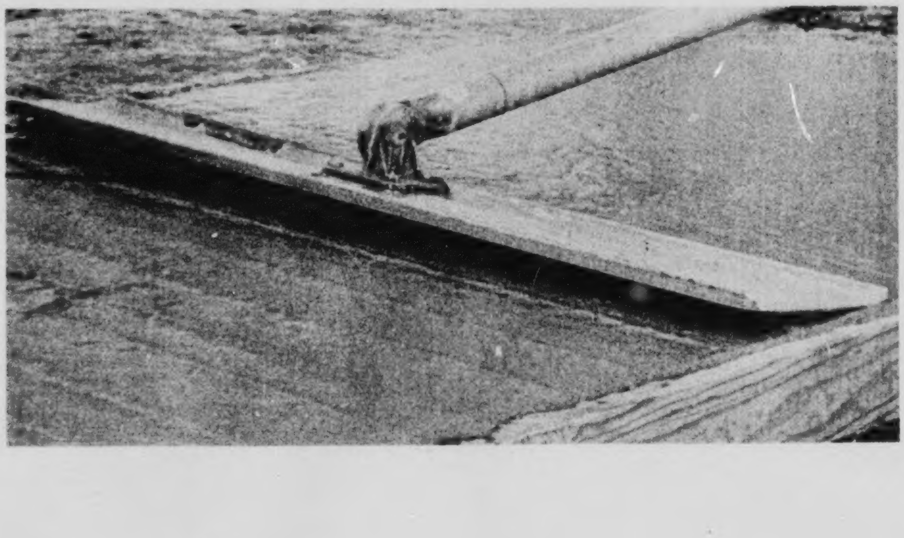
C. Bullfloat surface with a forward and backward movement across walk immediately after rodding

(NOTE: When working with colored concrete a magnesium bullfloat is best to use because a wood one creates too much drag.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 4)

FIGURE 4

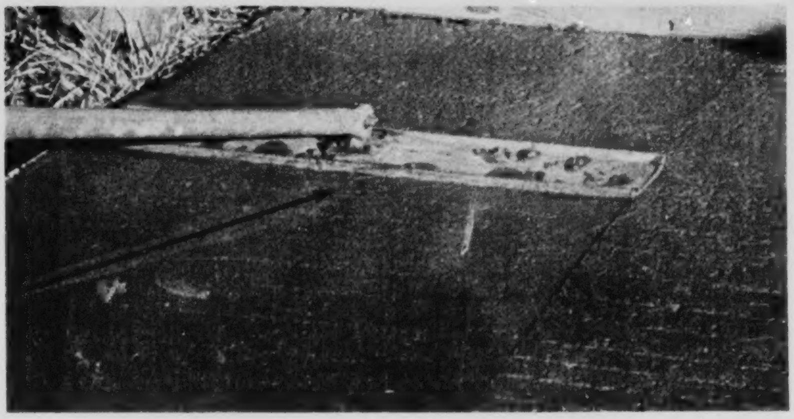
Point A



JOB SHEET #9

E. Position handle of bullfloat so that the blade at point B is relatively flat to the surface on backward motion (Figure 5)

FIGURE 5

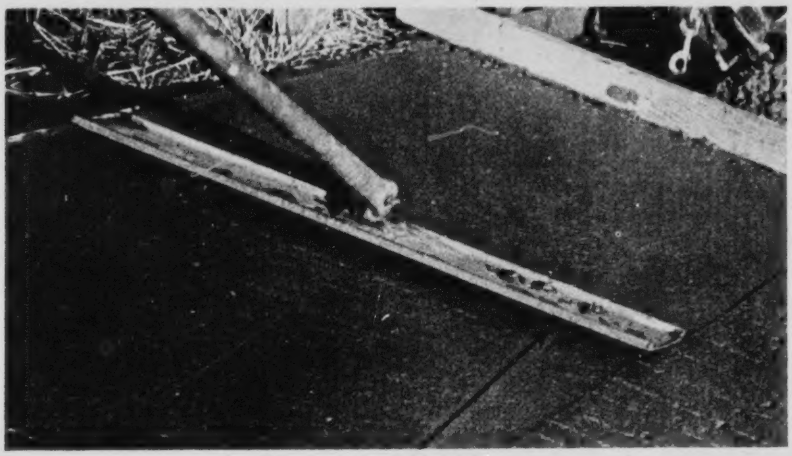


Point B

F. Make another pass over first pass

(NOTE: This time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised. See Figure 6.)

FIGURE 6



Point B

G. Overlap previous pass slightly and continue process until walk has been floated

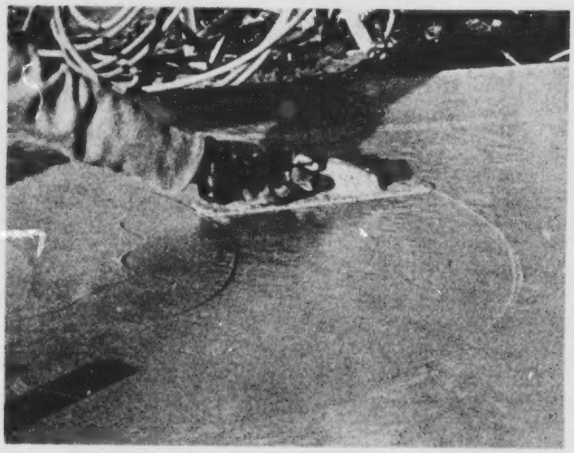
(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave. This is not usually so when using air-entrained concrete.)

JOB SHEET #9

H. Float concrete at start of pour with float at arm's length, moving float in a wide semicircular motion until surface is smooth and free of high and low places; keep float relatively flat to surface (Figure 7)

(CAUTION: Keep float at right angles to form when working along edge of form.)

FIGURE 7



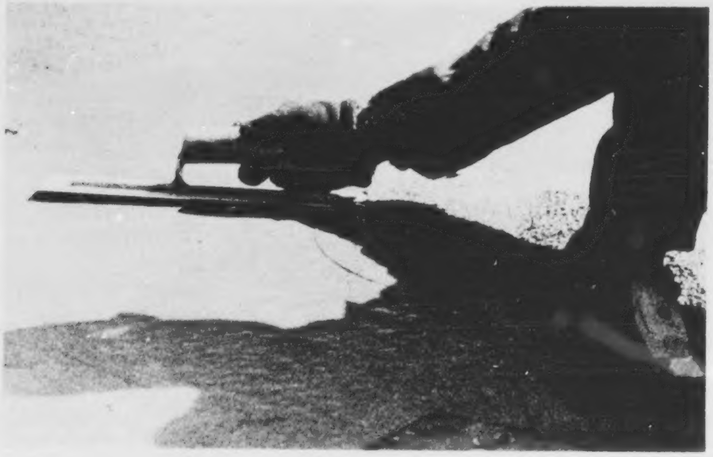
I. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

(CAUTION: Thoroughly clean tools are important when working with colored concrete.)

J. Extend trowel at arm's length and move it in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 8)

FIGURE 8



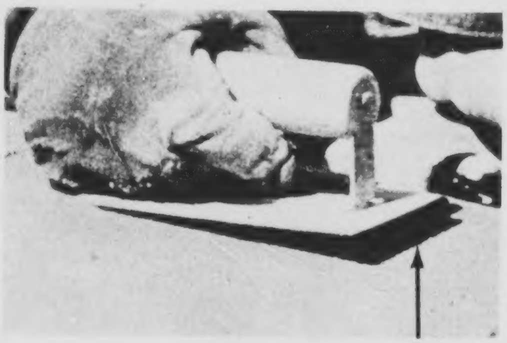
JOB SHEET #9

K. Continue troweling until walk has been completed

L. Tilt point A of edger slightly up, move forward in an arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 9)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

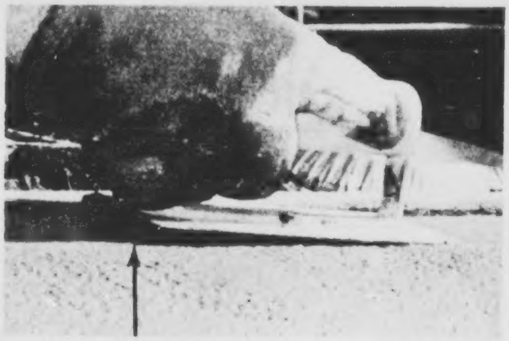
FIGURE 9


Point A

M. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 10)

(CAUTION: To avoid low places do not place too much pressure on edger.)

FIGURE 10


Point B

JOB SHEET #9

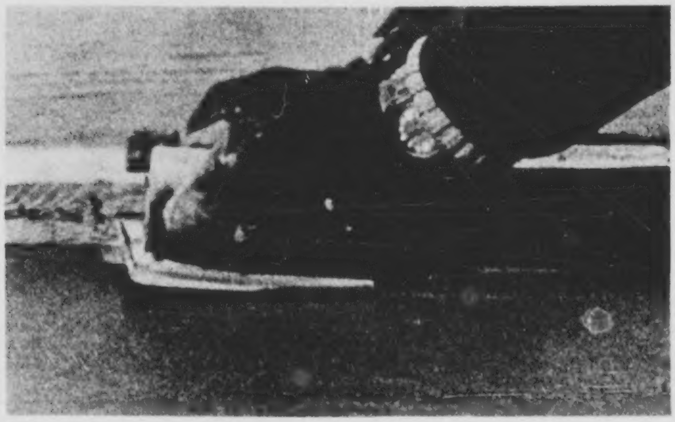
N. Continue this procedure until all edges are rounded and smooth

O. Edge all expansion joints, following edging procedure and taking all precautions

P. Use rule or tape to measure and mark all joints as specified

Q. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool (Figure 11)

FIGURE 11



R. Reverse tool and pull back across the joint after running jointer across walk

(NOTE: This will give a smooth finish.)

S. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make impression, it may be necessary to use a hatchet or hammer and chisel to make first cut. Then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be obtained.)

T. Rerun edger and jointer again to smooth out joints and edges

U. Start finish troweling at point of first troweling or at hardest point of concrete

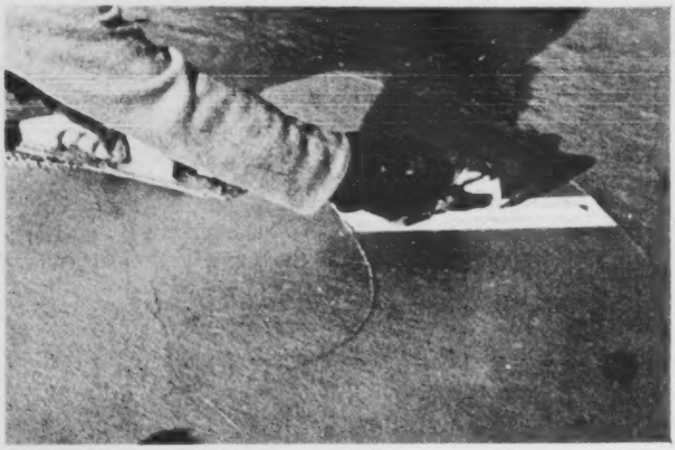
(CAUTION: When troweling colored concrete, caution must be taken not to trowel concrete too hard because it will create blemishes on the surface, especially in lighter colors.)

JOB SHEET #9

V. Extend trowel at arm's length and move trowel in a wide semicircular fanlike motion, keeping trowel flat to surface

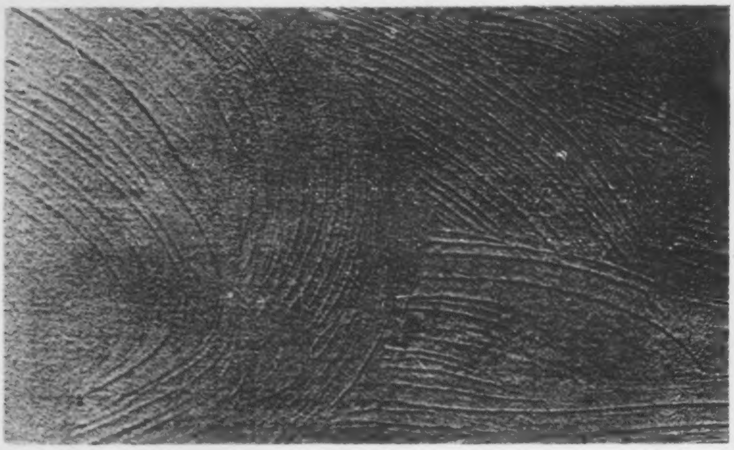
(NOTE: This will leave a fine, fuzzy, fanlike pattern. See Figure 12.)

FIGURE 12



W. Continue this process until entire walk is completed (Figure 13)

FIGURE 13



X. Apply curing agent using sprayer with nozzle adjusted to a fine mist

(CAUTION: Be sure to use curing agent that is specified.)

Y. Protect concrete by covering to prevent blemishes and damage to surface

Z. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

JOB SHEET #10--PLACE AND FINISH SIDEWALK WITH FINE BROOM FINISH USING COLOR WITH DRY SHAKE METHOD

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float
4. Finishing trowels
5. Edger
6. Jointer
7. Push broom, fine
8. Margin trowel
9. Brush
10. Sprayer
11. Bucket

B. Materials

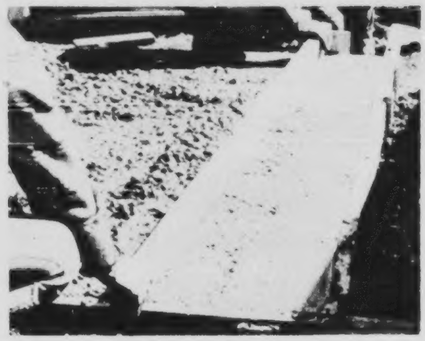
1. Concrete
2. Water in container
3. Colored dry shake
4. Curing agent

JOB SHEET #10

II. Procedure

A. Place concrete at starting point (Figure 1)

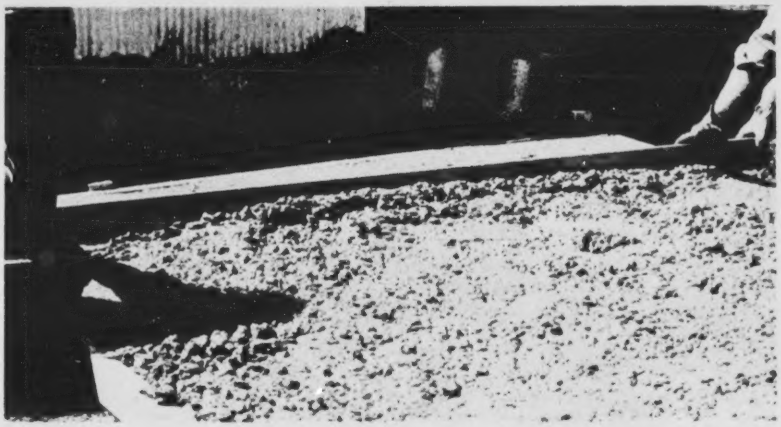
FIGURE 1



B. Use straightedge with sawlike motion and rod concrete (Figure 2)

(NOTE: Straightedge must be from one to two feet longer than widest distance that is to be rodded.)

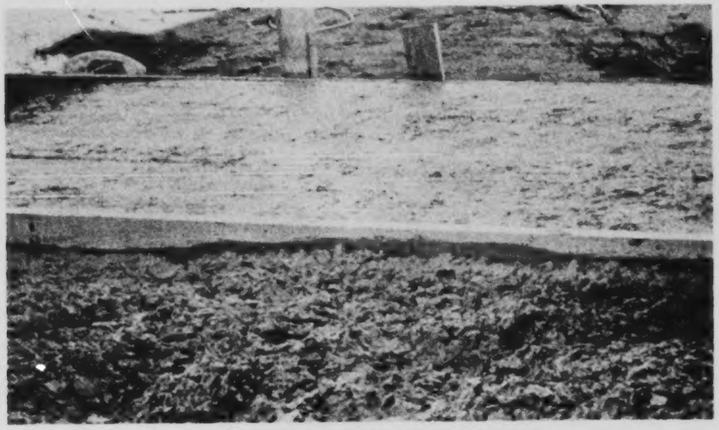
FIGURE 2



JOB SHEET #10

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes. See Figure 3.)

FIGURE 3

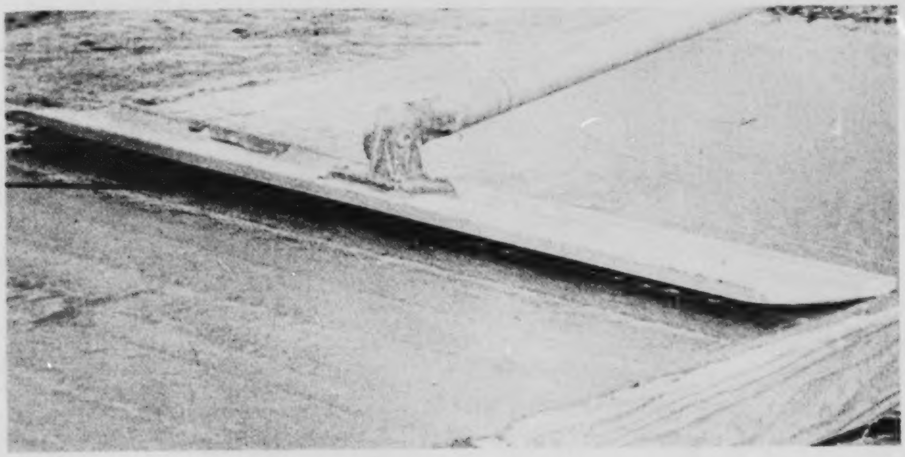


C. Bullfloat surface with a forward and backward movement across walk

(NOTE: This step should be done immediately after rodding.)

D. Position handle of bullfloat so that blade at point A is slightly tilted up on forward motion (Figure 4)

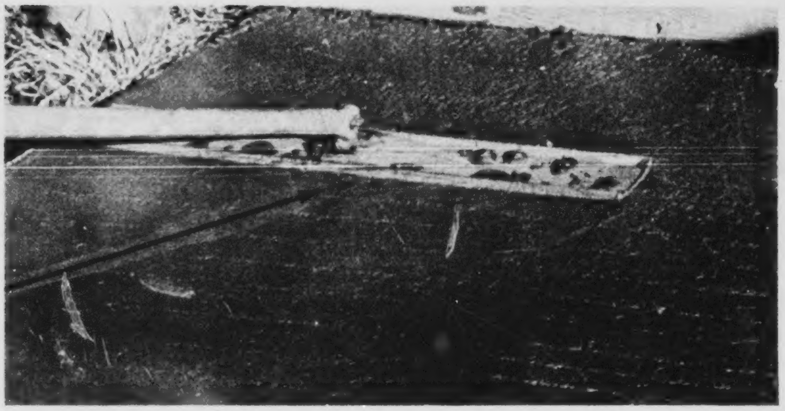
FIGURE 4



JOB SHEET #10

E. Position handle of bullfloat so that blade at point B is relatively flat to surface on backward motion (Figure 5)

FIGURE 5

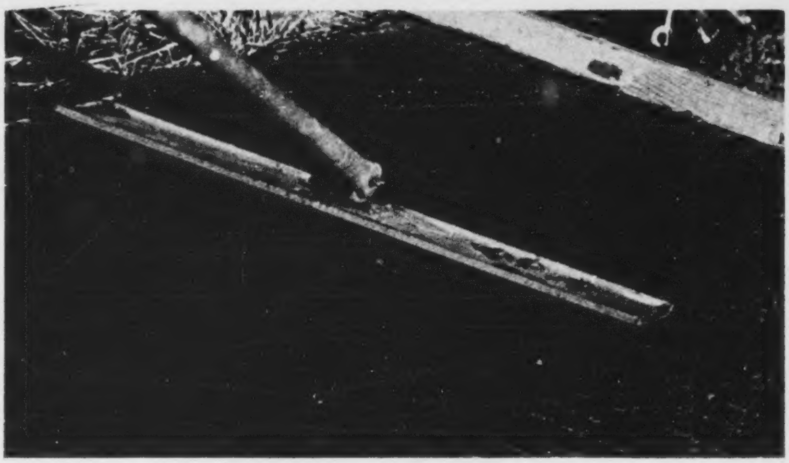


Point B

F. Make another pass over first pass

(NOTE: This time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised. See Figure 6.)

FIGURE 6



Point B

JOB SHEET #10

G. Overlap previous pass slightly and continue process until walk has been floated

(CAUTION: Occasionally a time period needs to elapse after bullfloating for concrete to harden and bleed water to leave before applying dry shake.)

H. Apply first shake of coloring using hand and bucket; use about two-thirds of material specified, applying it so that it is distributed evenly over entire walk

I. Float first shake into surface as soon as it has taken on enough moisture

(CAUTION: Keep float at right angles to forms when working along edge of forms.)

J. Float edges with float relatively flat and at arm's length; move in wide semicircular motion until dry shake is worked in and surface is smooth and free of high and low places (Figure 7)

FIGURE 7

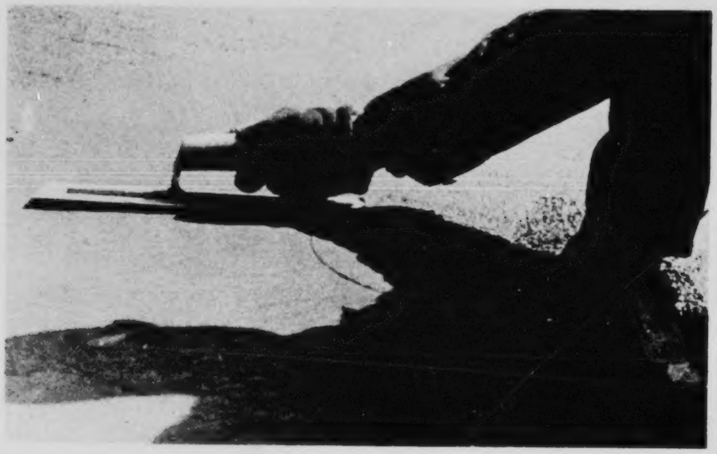
K. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

JOB SHEET #10

L. Extend trowel at arm's length and move it in a wide semicircular motion; tilt trowel slightly and work surface until smooth (Figure 8)

FIGURE 8

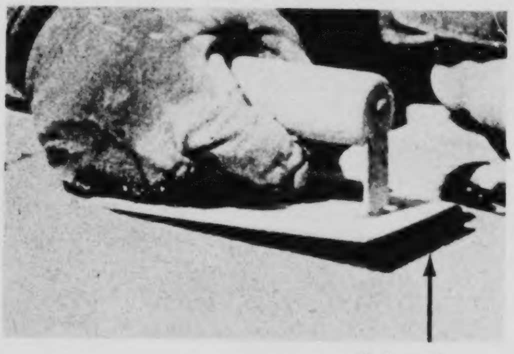


M. Continue troweling until walk has been completed

N. Tilt point A of edger slightly up, move forward in arm's length pattern, and, while still in motion, lift edger at end of pass (Figure 9)

(CAUTION: To avoid picking up surface of concrete, do not remove edger from concrete surface unless edger is in motion.)

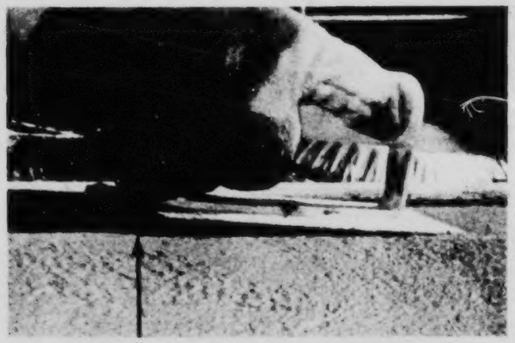
FIGURE 9



JOB SHEET #10

O. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 10)

FIGURE 10



Point B

(CAUTION: To avoid low places do not place too much pressure on edger. See Figure 11.)

FIGURE 11

P. Continue this procedure until all edges are rounded and smooth

Q. Edge all expansion joints, following edging procedure and taking all precautions

R. Use rule or tape to measure and mark location of all joints as specified

JOB SHEET #10

S. Use straightedge as guide and run jointer across walk along side of straightedge, applying slight pressure to back of tool

T. Reverse tool and pull back across the joint after running jointer across walk

(NOTE: This will give a smooth finish.)

U. Continue using straightedge and jointer until all joints have been cut

(NOTE: If concrete hardens to point where jointer will not make depression, it may be necessary to use a hatchet or hammer and chisel to make first cut. Then use jointer to work and smooth joint. Allow enough time after jointing until desired finish can be obtained.)

V. Apply remaining one-third of dry shake material

(NOTE: Be careful to spread shake evenly.)

W. Start floating walk, again working in dry shake

X. Float walk with float relatively flat and at arm's length; move in wide semicircular motion until dry shake is worked in and surface is smooth and free of high and low places

Y. Trowel surface of concrete with finishing trowel, using same method as floating

(NOTE: This step should be done immediately after floating an area.)

(CAUTION: Thoroughly clean tools are important when working with colored concrete.)

Z. Extend trowel at arm's length and move it in a wide semicircular motion; tilt trowel slightly and work surface until smooth

AA. Continue troweling until walk has been completed

BB. Rerun edges and expansion joints to work in dry shake and to leave edges round and smooth

CC. Rerun joints with jointer

DD. Retrowel surface to work out all edger and jointer marks

EE. Continue troweling until entire walk has been troweled

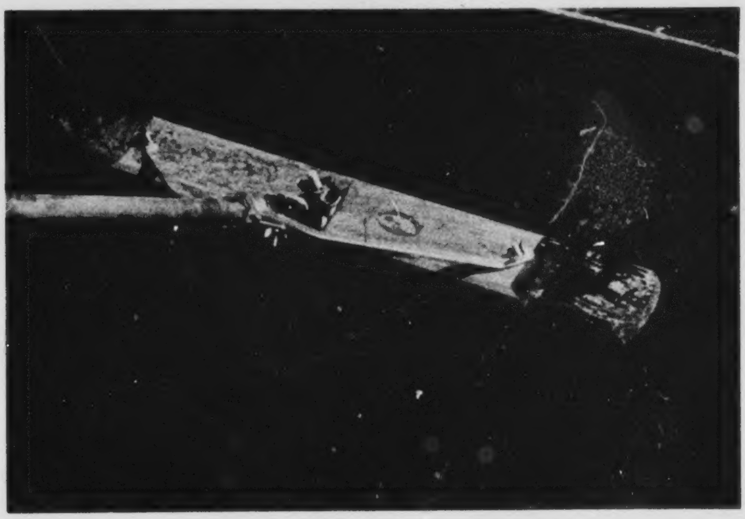
JOB SHEET #10

(CAUTION: When troweling colored concrete, caution must be taken not to trowel concrete too hard because it will create blemishes on the surface, especially in lighter colors.)

FF. Start broom finish by placing broom across walk and pulling forward across the walk (Figure 12)

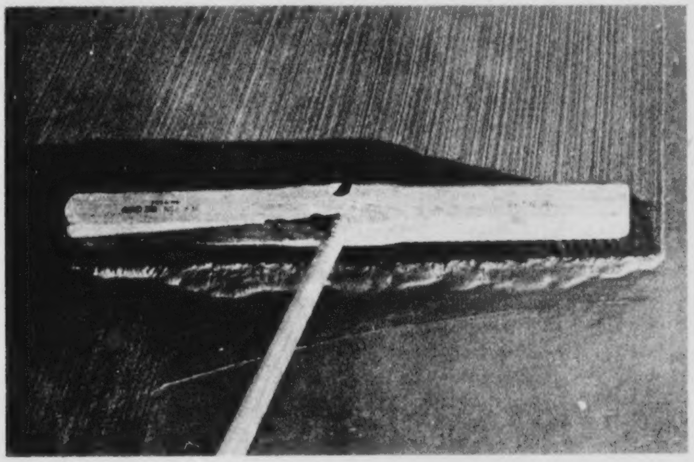
(NOTE: Broom finish pattern is usually specified to be at right angles with direction of travel. Occasionally specifications may call for each block (between joints) to be broomed at right angles to each other.)

FIGURE 12



GG. Swing broom back to starting edge and repeat pulling across slab, slightly lapping preceding pass (Figure 13)

FIGURE 13



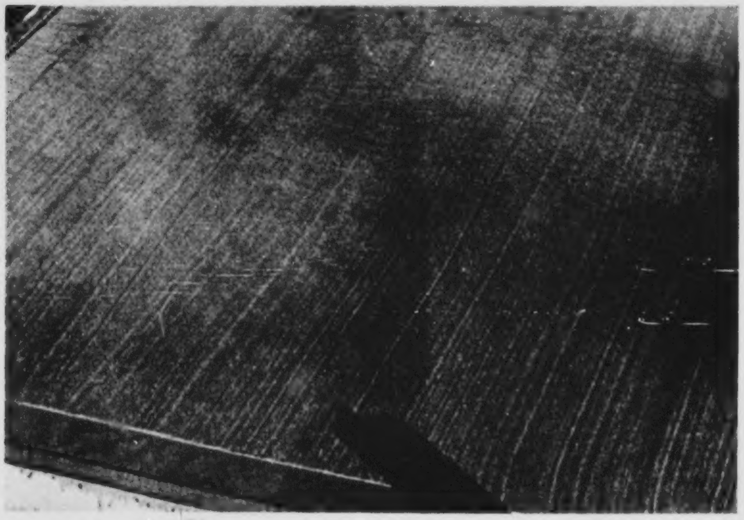
JOB SHEET #10

HH. Continue this procedure until entire walk has been broomed (Figure 14)

FIGURE 14

(NOTE: Sometimes specifications will call for edger and jointer marks to be left exposed, especially on broom finishes. See Figure 15.)

FIGURE 15



II. Rerun edger and jointer taking precautions as to putting too much pressure on tools and picking up tools from surface

JJ. Apply curing agent using sprayer with nozzle adjusted to a fine mist

(CAUTION: Be sure to use curing agent that is specified.)

KK. Protect concrete by covering to prevent blemishes and damage to the surface

LL. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks. (Terms and definitions continued on next page.)

_____a. Mixture of sand, cement, and water

_____b. Very hard, irridescent, abrasive compound

_____c. Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

_____d. Type of finish produced by working salt into surface and then washing salt away after curing

_____e. Joint cut in concrete to induce cracking at this point rather than at random

_____f. Type of finish that is produced by dashing a soupy mixture of mud on surface and then troweling

_____g. Process of troweling concrete and leaving surface with a fuzzy, fanlike pattern

_____h. Abrasive material sprinkled on surface of concrete and worked in to create a nonskid surface

_____i. Tools used to make a design on the surface of concrete

_____j. Variety of finishes and/or patterns used on walks and patios

_____k. Very hard, abrasive grains

_____l. Tool used to cut grooves in concrete

_____m. Joint cut to isolate one section of concrete from another or to cut around rigid objects

1. Joints
2. Nonskid material
3. Subgrade
4. Swirl finish
5. Exposed aggregate finish
6. Keystone or travertine finish
7. Construction joint
8. Control joint
9. Isolation joint
10. Rock salt finish
11. Jointer
12. Expansion joint material
13. Aluminum oxide grits
14. Silicon carbide grits
15. Geometric finishes
16. Mud
17. Stamping pads
18. Seed
19. Vapor barrier

_____n. Joint placed where pour is temporarily suspended

_____o. Type of finish where aggregate is exposed through a wash and broom process

_____p. Soil prepared and compacted to support a structure or a pavement system

_____q. Grooves sawed or tooled in concrete

_____r. Agent applied to the concrete surface to keep it from setting too fast; usually used on exposed aggregate work

_____s. Chemical compound used to prevent evaporation of moisture from concrete

_____t. Layer of material used to prevent the absorption of moisture

_____u. To sprinkle aggregate on the surface of concrete when finishing exposed aggregate work

_____v. Application of a dry color topping material

20. Curing agent

21. Dry shake

22. Surface retarder

2. Select from the list below three steps to take before pouring a walk or patio. Circle the correct letters.

a. Make sure there is proper slope for drainage

b. Type of subgrade

c. Slump of concrete

d. Set forms to grade

e. Temperature of water

f. Check that subgrade is on grade and relatively smooth

g. Type of finish

3. Arrange in order steps to take when placing and finishing a sidewalk or patio. Place a "1" in the blank before the first step, a "2" before the second step, and so on.

______a. Darby or bullfloat

______b. Edge

______c. Cut joints

______d. Rod

______e. Trowel

______f. Jitterbug or rollerbug

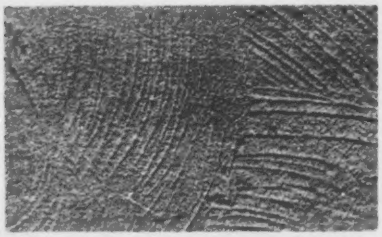
______g. Finish

______h. Hand float

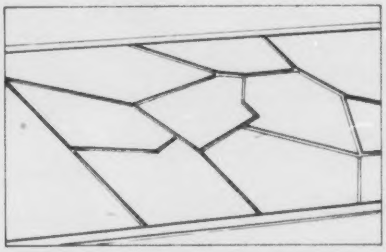
4. Identify the types of concrete finishes below by writing the correct names in the blanks provided.

a. ______________________________

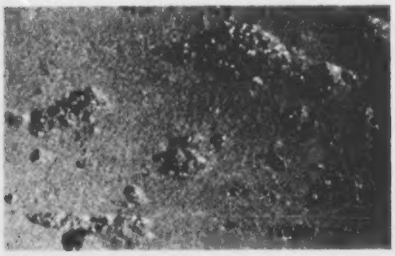
b. ______________________________



c. ______________________________

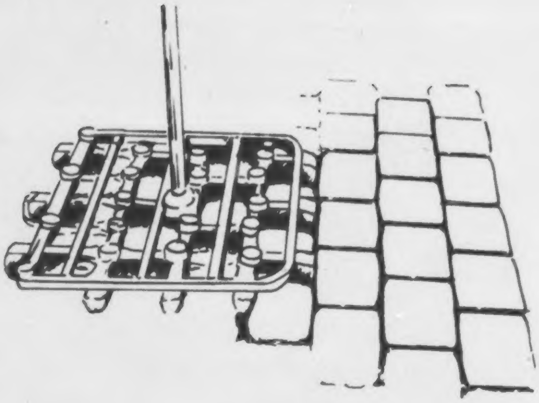


d. ______________________________



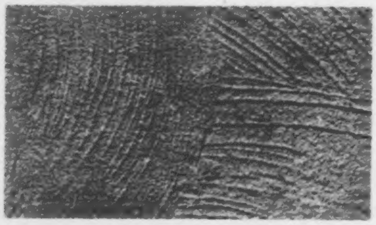
e. ______________________________

f. ______________________________



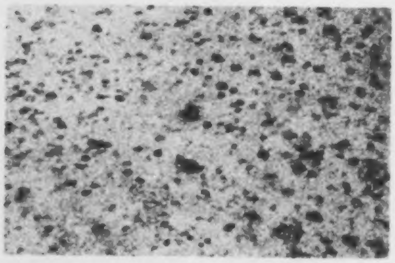
g. ________________________

h. ________________________



i. ________________________

j. ________________________

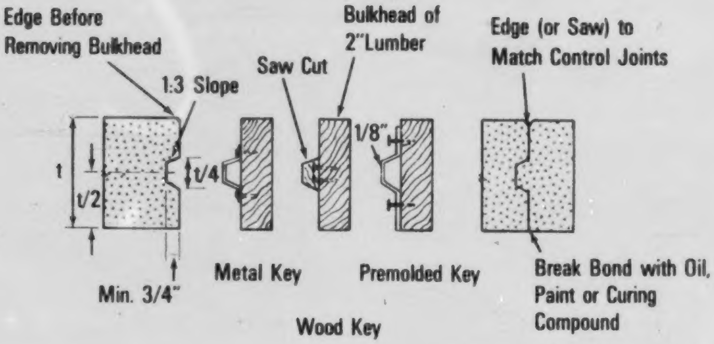


k. ________________________

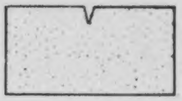
l. ________________________

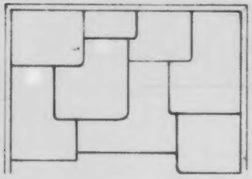
m. ________________________

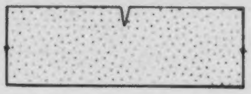
5. Identify the types of joints illustrated below by writing the correct names in the blanks provided.

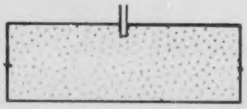

Edge Before Removing Bulkhead
1:3 Slope
t
t/2
t/4
Min. 3/4"
Saw Cut
Bulkhead of 2"Lumber
1/8"
Metal Key
Premolded Key
Wood Key
Edge (or Saw) to Match Control Joints
Break Bond with Oil, Paint or Curing Compound

a. ______________________________

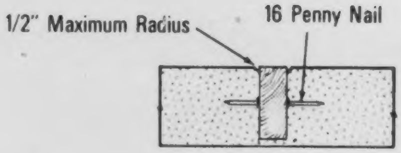




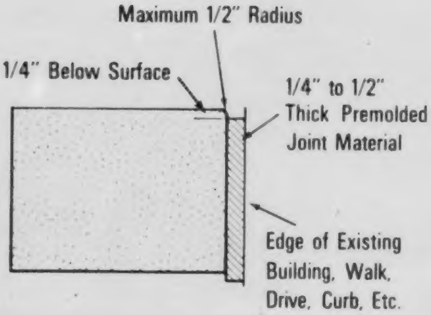




b. ____________________


1/2" Maximum Radius
16 Penny Nail

c. ______________________________


Maximum 1/2" Radius
1/4" Below Surface
1/4" to 1/2" Thick Premolded Joint Material
Edge of Existing Building, Walk, Drive, Curb, Etc.

d. ______________________________

6. List three reasons joints are important in walks and patios.

   a.

   b.

   c.

7. Match the type of joints on right to the proper locations. Place the correct numbers in the blanks provided. A number may be used more than once.

   ______a. Points of potential stress

   ______b. Where pour is temporarily suspended

   ______c. Intersections of concrete

   ______d. Spaced at intervals about equal to width of walk

   ______e. To create decorative pattern

   ______f. Where walks and patios adjoin other slabs, buildings, and curbs

   ______g. Patios larger than ten to twelve feet should have lengthwise joint down center

   1. Control joint

   2. Expansion or isolation joint

   3. Construction joint

   4. Decorative joint

8. Select nonskid materials from the list below. Circle the correct letters.

   a. Fine alkali aggregate

   b. Silicon carbide grits

   c. Rock salt

   d. Fuzzy swirl finish

   e. Calcium chloride

   f. Aluminum oxide grits

9. Demonstrate the ability to:

   a. Place and finish sidewalk with float finish.

   b. Place and finish sidewalk with fine swirl finish.

   c. Place and finish sidewalk with fine broom finish.

   d. Place and finish sidewalk with exposed aggregate finish.

   e. Place and finish sidewalk with swirl finish using nonskid materials.

f. Place and finish sidewalk with rock salt finish.

g. Place and finish sidewalk with travertine or keystone finish.

h. Place and finish sidewalk with geometric finish.

i. Place and finish sidewalk with fine swirl finish using ready-mix color.

j. Place and finish sidewalk with fine broom finish using color and dry shake method.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

FINISHING CONCRETE SIDEWALKS AND PATIOS
UNIT VI

ANSWERS TO TEST

1. a. 16
   b. 14
   c. 12
   d. 10
   e. 8
   f. 6
   g. 4
   h. 2
   i. 17
   j. 15
   k. 13
   l. 11
   m. 9
   n. 7
   o. 5
   p. 3
   q. 1
   r. 22
   s. 20
   t. 19
   u. 18
   v. 21

2. a, d, f

3. a. 3
   b. 6
   c. 7
   d. 1
   e. 5
   f. 2
   g. 8
   h. 4

4. a. Geometric (Circle)
   b. Geometric (Leaf pattern)
   c. Swirl
   d. Geometric (Flagstone)
   e. Keystone or travertine
   f. Float
   g. Geometric (Stamping pads)
   h. Colored
   i. Swirl with nonskid material
   j. Trowel
   k. Rock salt
   l. Exposed aggregate
   m. Broom

5. a. Construction joints
   b. Decorative joint
   c. Control joints

d. Expansion joint

6. a. Eliminate random cracks
   b. Allow for expansion and contraction
   c. Enhance the appearance

7. a. 2
   b. 3
   c. 2
   d. 1
   e. 4
   f. 2
   g. 1

8. b, f

9. Performance skills evaluated to the satisfaction of the instructor

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match illustrations of curbs and curb and gutters to their proper names. He should be able to identify types of finishes for residential and commercial drives. He should be able to discuss concrete thickness variations for drives and demonstrate the ability to place and finish curbs and curbs and gutters. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with finishing concrete drives, approaches, and curbs to the proper definitions.
2. Name types of drives and approaches.
3. Match types of curbs and curbs and gutters to their proper names.
4. Select from a list factors to consider before starting an approach.
5. Identify types of finishes for residential drives.
6. Identify types of finishes for commercial drives.
7. Discuss in a short paragraph concrete thickness variations for drives.
8. Name three methods of drainage for drives.
9. Demonstrate the ability to:
    a. Place and finish approach with curbs.
    b. Place and finish roll type curb and gutter.
    c. Place and finish drive with curbs.
    d. Place and finish straight curb.

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information and job sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Types of Approaches

      2. TM 2--Types of Approaches (Continued)

   3. TM 3--Types of Curbs and Curbs and Gutters
   4. TM 4--Methods of Drainage for Drives

D. Job sheets

   1. Job Sheet #1--Place and Finish Approach with Curbs
   2. Job Sheet #2--Place and Finish Roll Type Curb and Gutter
   3. Job Sheet #3--Place and Finish Drive with Curbs
   4. Job Sheet #4--Place and Finish Straight Curb

E. Test

F. Answers

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

INFORMATION SHEET

I. Terms and definitions

   A. Approach--Entrance to a drive

   B. Crown--Fall or pitch from center to each side

   C. Inverted crown--Fall or pitch from sides to center

   D. Cross slope--Fall or pitch from one side to the other

   E. Recreational drive--Type of drive used for recreation, such as cookouts, basketball, and shuffleboard

   F. Mud--Mixture of sand, cement, and water

   G. Flush--Even with

   H. Wet grade--Fresh concrete that has been set to grade; used to make a screed

   I. Isolation joint--Isolates one section of concrete from another; isolates concrete from other rigid objects

   J. Expansion joint--Type of isolation joint

   K. Expansion joint material--Preformed piece of compressive material used to separate units of concrete to prevent damage due to expansion

   L. Mule--Template used to shape the profile of a curb and gutter

   M. Low slump--Stiff concrete

   N. Division plate--Thin steel plate placed between forms to provide full depth joints in a curb and gutter

   O. Slab--Poured concrete floor

   P. Layed down--Phrase used for first floating and/or troweling of concrete

   Q. Rubbing--Process of rubbing or grinding concrete

   R. Battered--Receding upward slope of the face of a form or structure

INFORMATION SHEET

- S. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete
- T. Form oil--Manufactured product used on forms to prevent adhesion of the concrete to the form

II. Types of drives and approaches (Transparencies 1 and 2)

- A. Residential
- B. Commercial

  (NOTE: Usually curbs are poured along with commercial drives and approaches. Most residential drives do not have curbs.)

III. Types of curbs and curbs and gutters (Transparency 3)

- A. Straight face, vertical
- B. Straight face, battered
- C. Single radius, vertical
- D. Single radius, battered
- E. Double radius, vertical
- F. Double radius, battered
- G. Roll type
- H. Highway gutter
- I. Precast
- J. Straight curb
- K. Partially battered curb
- L. Fully battered curb

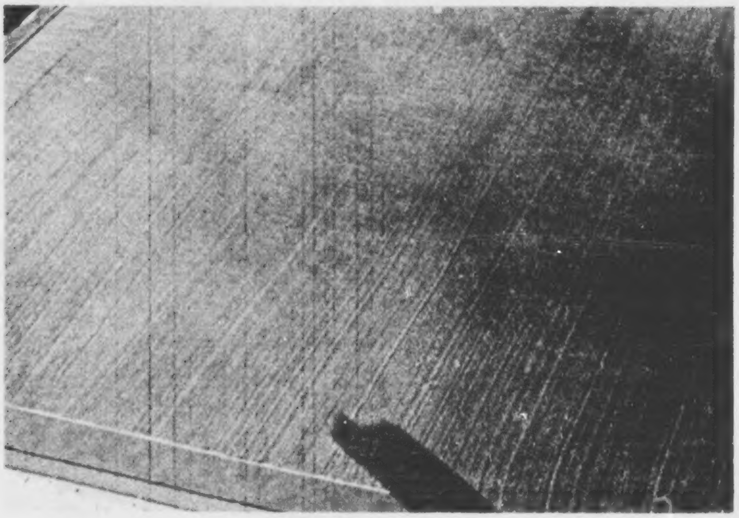
IV. Factors to consider before starting an approach

- A. Design
- B. Size
- C. County, city, state, and federal codes and/or ordinances

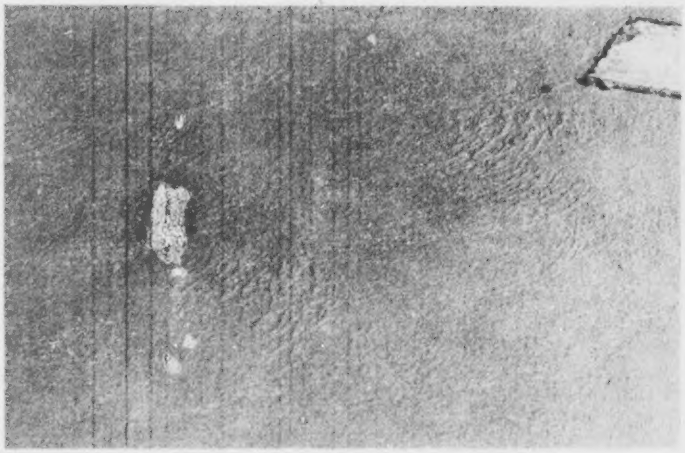
INFORMATION SHEET

V. Types of finishes for residential drives

A. Broom

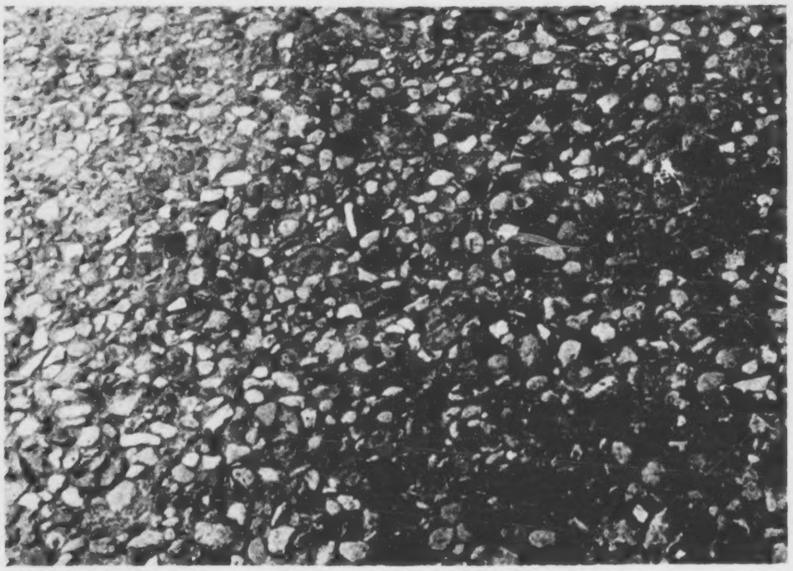


B. Float

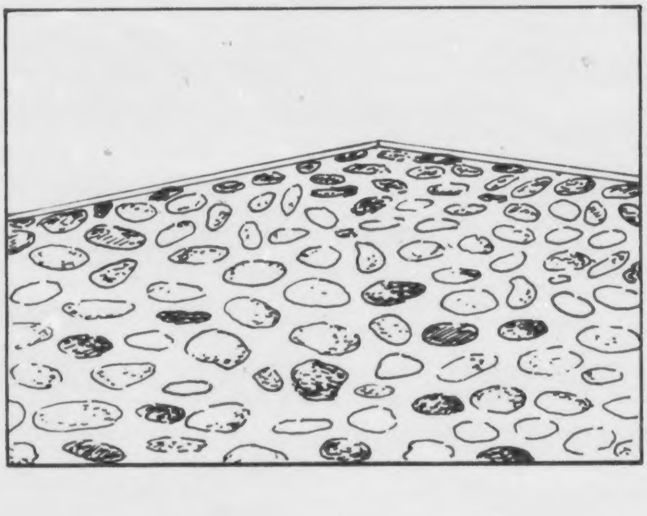


INFORMATION SHEET

C. Exposed aggregate

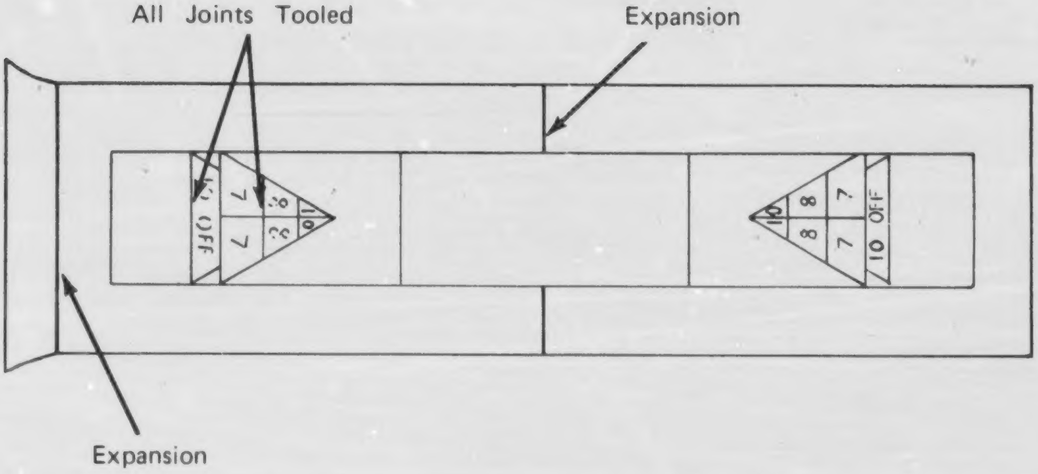


D. Cobblestone



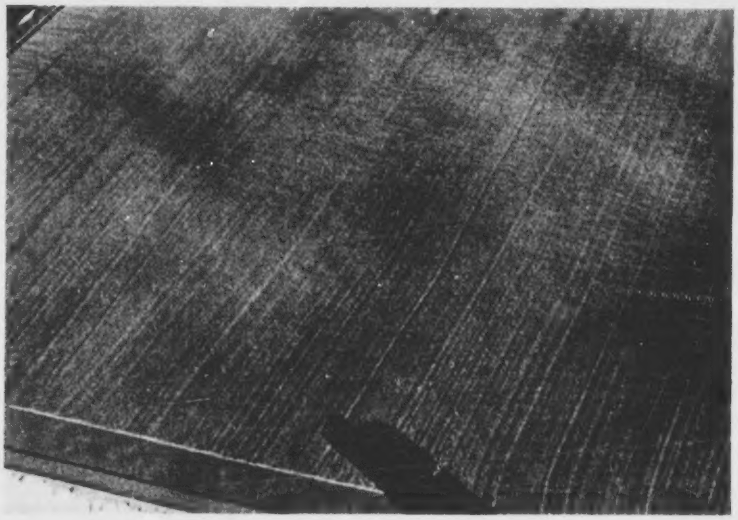
INFORMATION SHEET

E. Recreational


All Joints Tooled
Expansion
10 OFF
7
8
10
7
8
10 OFF
Expansion

VI. Types of finishes for commercial drives

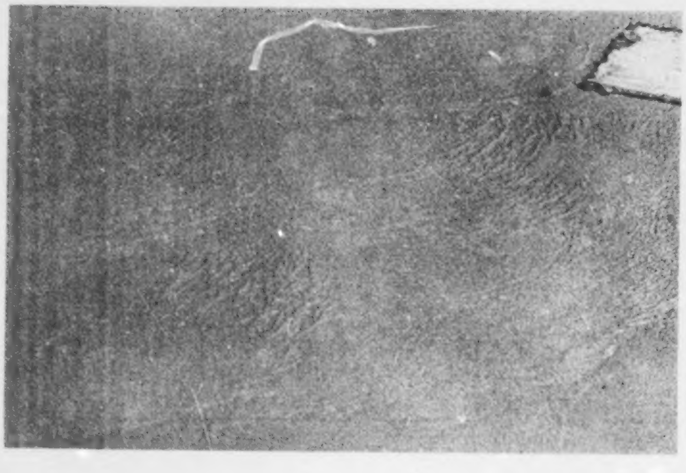
A. Broom



INFORMATION SHEET

B. Machine

C. Float



INFORMATION SHEET

D. Burlap

VII. Concrete thickness variations for drives

A. Residential drives

1. Four inches minimum

2. Increased if drive is subjected to heavy truck traffic

B. Commercial drives

1. Six inches minimum

2. Increased to eight inches if drive is subjected to extra heavy traffic

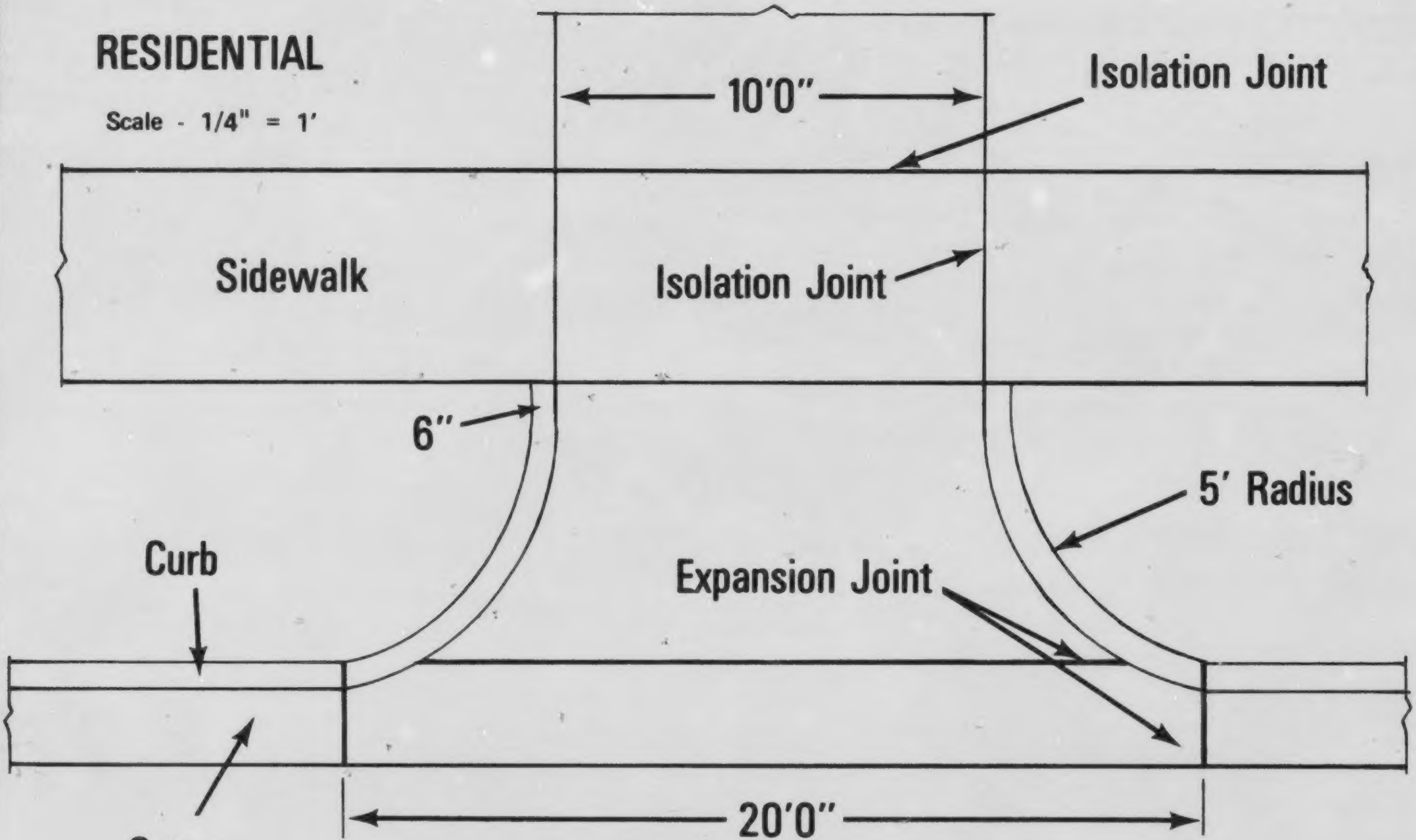
VIII. Methods of drainage for drives (Transparency 4)

A. Crown

B. Inverted crown

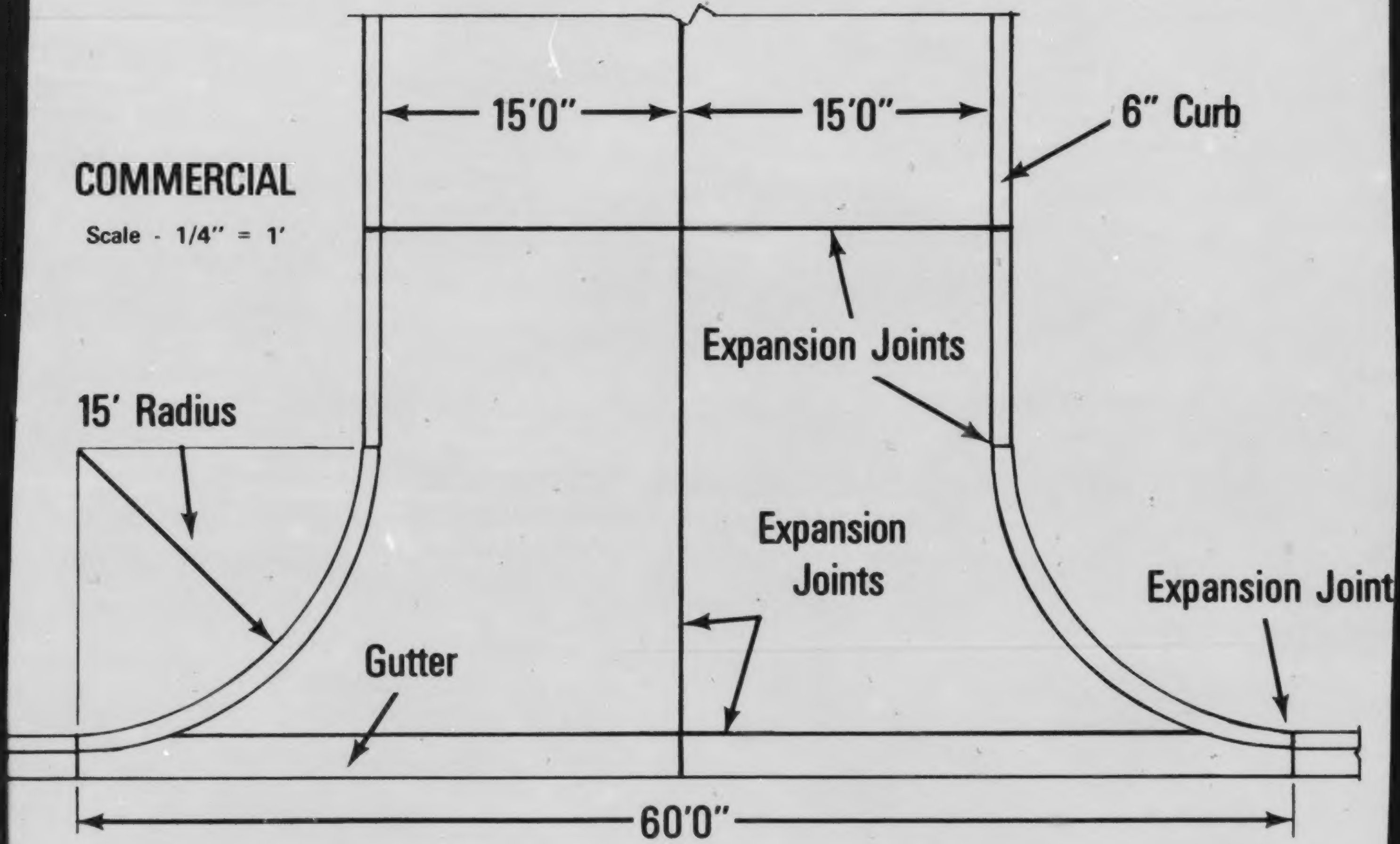
C. Cross slope

Types of Approaches

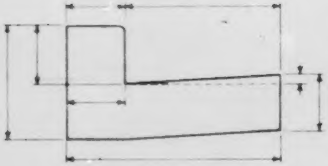

RESIDENTIAL
Scale - 1/4" = 1'
10'0"
Isolation Joint
Sidewalk
Isolation Joint
6"
5' Radius
Curb
Expansion Joint
Gutter
20'0"

Types of Approaches

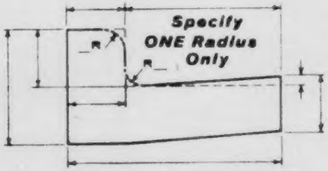
(Continued)


15'0"
15'0"
6" Curb
COMMERCIAL
Scale - 1/4" = 1'
Expansion Joints
15' Radius
Expansion Joints
Expansion Joints
Expansion Joint
Gutter
60'0"

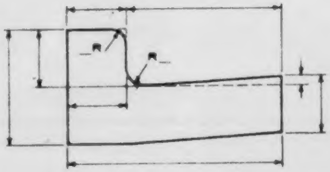
Types of Curbs and Curbs and Gutters



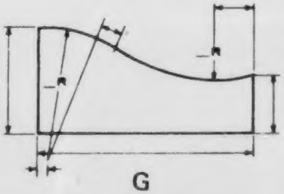
A
STRAIGHT FACE
Vertical


_R
R_
Specify ONE Radius Only

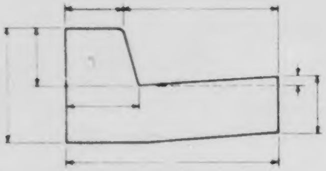
C
SINGLE RADIUS
Vertical



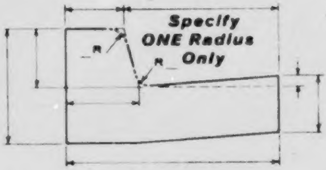
E
DOUBLE RADIUS
Vertical



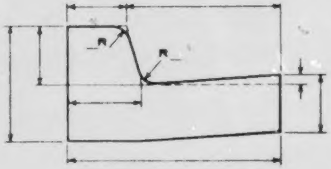
G
ROLL TYPE



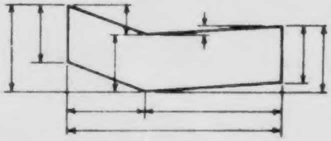
B
STRAIGHT FACE
Battered


_R
R_
Specify ONE Radius Only

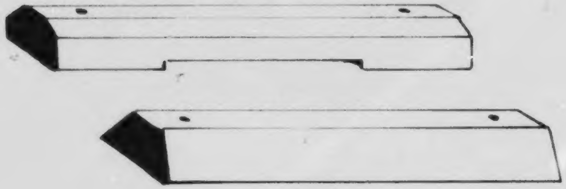
D
SINGLE RADIUS
Battered



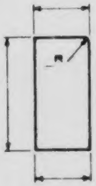
F
DOUBLE RADIUS
Battered



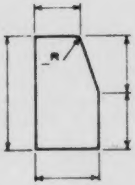
H
HIGHWAY GUTTER



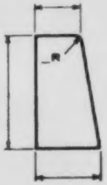
I
PRECAST



J
STRAIGHT
CURB

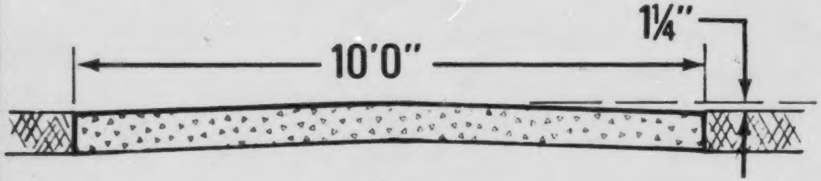


K
PARTIALLY
BATTERED
CURB

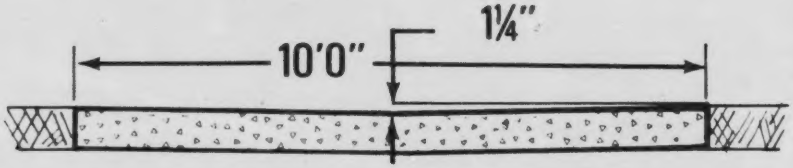


L
FULLY
BATTERED
CURB

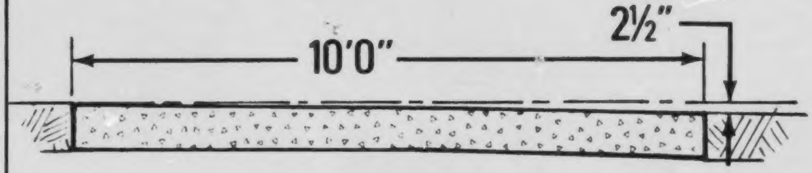
Methods of Drainage for Drives



Crown



Inverted Crown



Cross Slope

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

JOB SHEET #1--PLACE AND FINISH APPROACH WITH CURBS

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand float (magnesium)
4. Curb edger, 1 1/2" radius
5. Sidewalk edger, 3/8" radius
6. Pavement edger, 1 1/2" radius
7. Walking edger
8. Hammer
9. Knee boards
10. Cork or rubber float
11. Margin trowel
12. Brush
13. Midget trowel
14. Broom
15. Sprayer

B. Materials

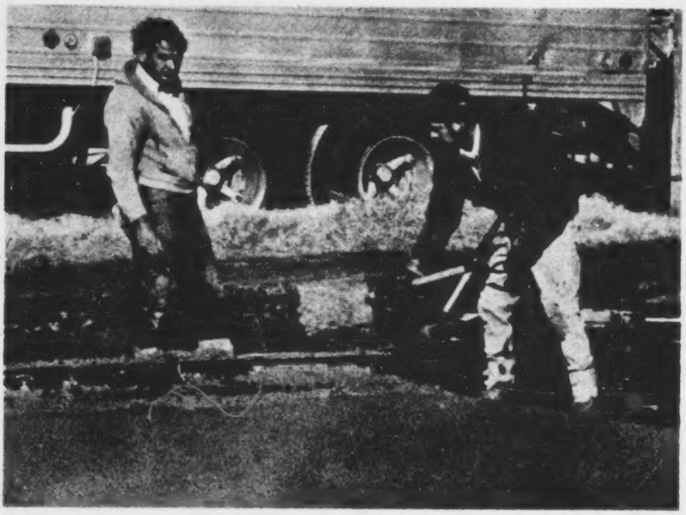
1. Concrete
2. Mud
3. Bucket of water
4. Curing agent

JOB SHEET #1

II. Procedure

A. Start pour in curb (Figure 1)

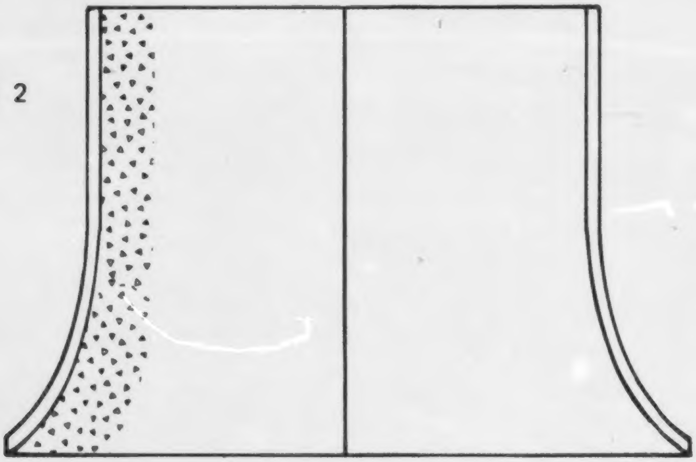
FIGURE 1



B. Fill curb and float surface flush with top of forms

C. Pour at base of curb and make wet grade by floating concrete flush with bottom of curb form (Figure 2)

FIGURE 2

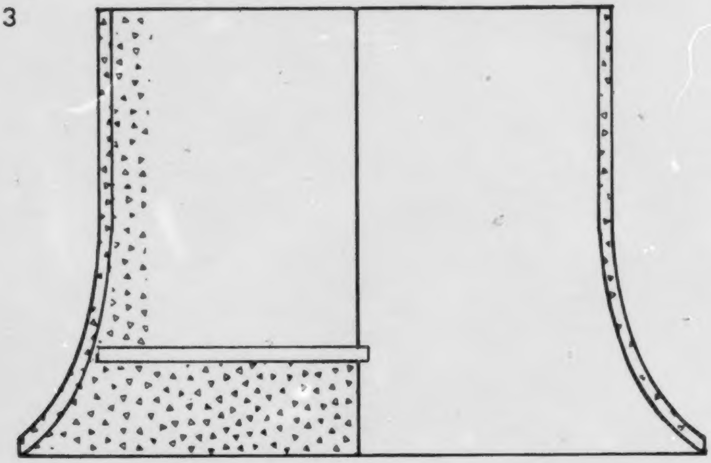


JOB SHEET #1

D. Pour across slab to expansion joint and start straightedging, using a sawlike motion and at same time backing up (Figure 3)

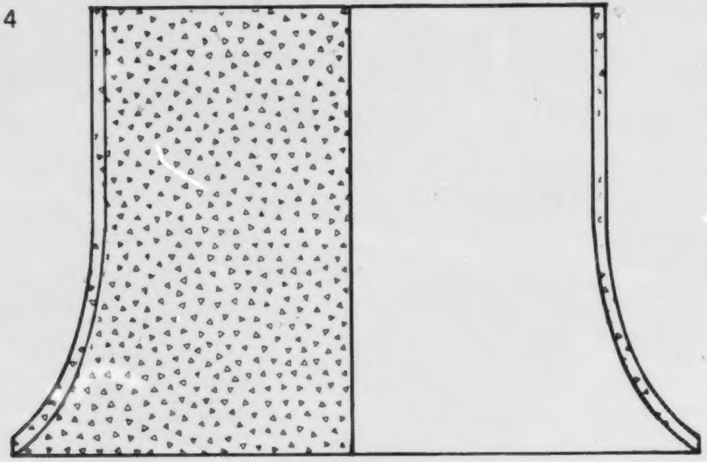
(NOTE: Most approaches have fall towards street; therefore, it is best to rod uphill.)

FIGURE 3



E. Continue straightedging and backing up until first half is poured (Figure 4)

FIGURE 4



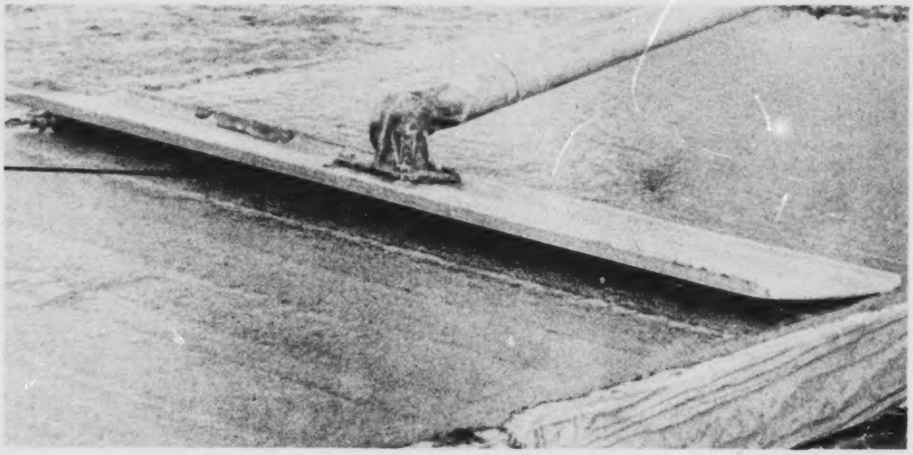
JOB SHEET #1

F. Bullfloat surface with a forward and backward movement

(NOTE: This should be done immediately after rodding.)

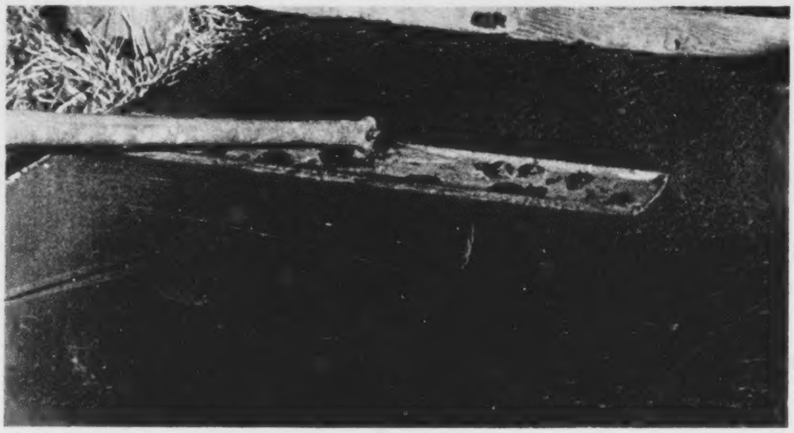
G. Position handle of bullfloat so blade at point A is slightly tilted up on forward motion (Figure 5)

FIGURE 5



H. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 6)

FIGURE 6



JOB SHEET #1

I. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 7)

FIGURE 7

J. Overlap previous pass slightly and continue process until slab has been floated

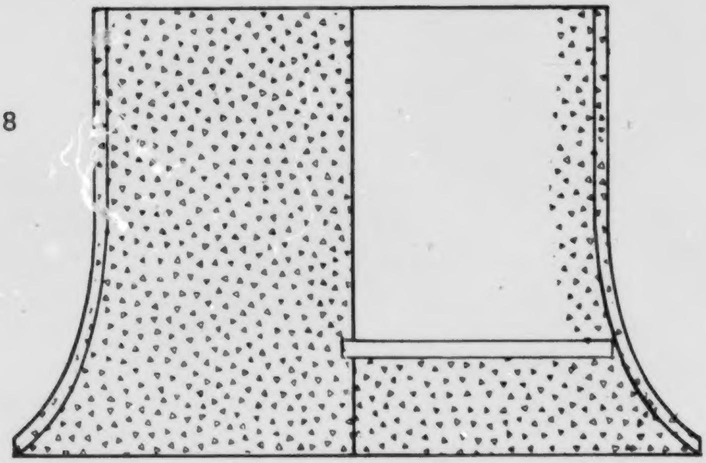
K. Continue pouring second half, following same procedures as before

L. Fill and float off curb

M. Fill along base of curb and make wet grade

N. Pour lower section of drive and straightedge, using a sawlike motion and moving backwards at same time (Figure 8)

FIGURE 8



O. Continue straightedging and backing up until approach is poured and straightedged

JOB SHEET #1

P. Bullfloat second half using same steps as on first half

(NOTE: Edges usually set faster; therefore, they should be floated and edged before the rest of the slab.)

(CAUTION: Occasionally a time period needs to elapse after bullfloating to allow concrete to harden and the bleed water to leave the concrete.)

Q. Float top of curb

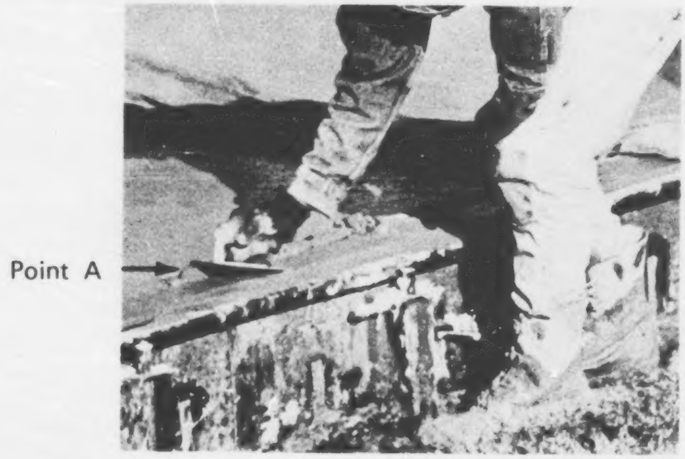
R. Use curb edger to edge front of curb

S. Use sidewalk edger to edge back of curb

T. Tilt point A of edger slightly up and move forward in an arm's length pattern (Figure 9)

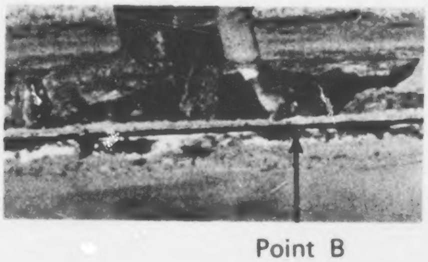
(NOTE: To avoid picking up surface of concrete lift edger only when it is still in motion.)

FIGURE 9



U. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 10)

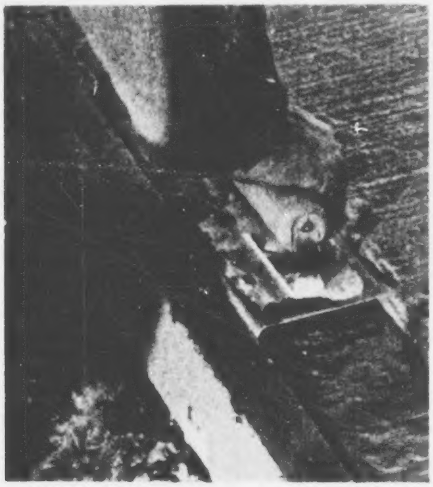
FIGURE 10



JOB SHEET #1

(CAUTION: To avoid low places do not put too much pressure on edger. See Figure 11.)

FIGURE 11



V. Continue this procedure until curb edges have all been rounded and smooth

W. Use margin trowel or midget trowel and trowel surface of curb to work out all edger marks

X. Continue this procedure until both curbs are floated and edged

Y. Start at hardest point and float edges of approach, using a wide semicircular motion until surface is smooth of high and low places

(CAUTION: Keep float at right angles to forms when floating along edge of form.)

Z. Edge front edge of approach (section next to street), taking same precautions as in previous steps

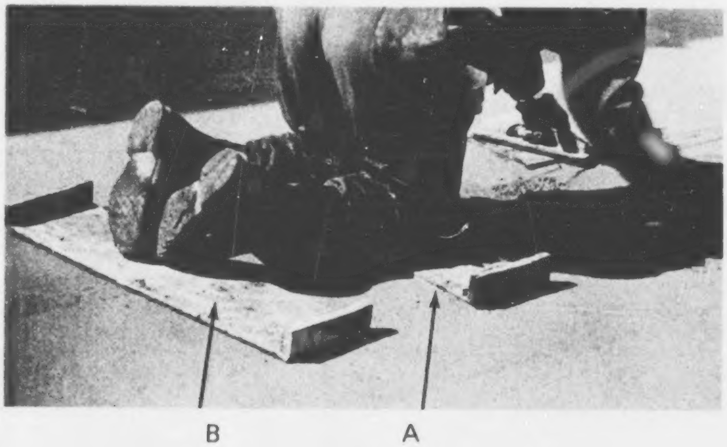
AA. Use 3/8" edger and edge rear section of approach

BB. Be sure concrete is hard enough to place knee boards on slab; float entire slab until surface is smooth of high and low places

JOB SHEET #1

(NOTE: Knee boards are used by positioning body so that both knees are on board A and toes on board B. Balance is obtained by leaning on a float held in the left hand and working with right hand. See Figure 12.)

FIGURE 12



CC. Work across expansion joint, edging with sidewalk edger or walking edger

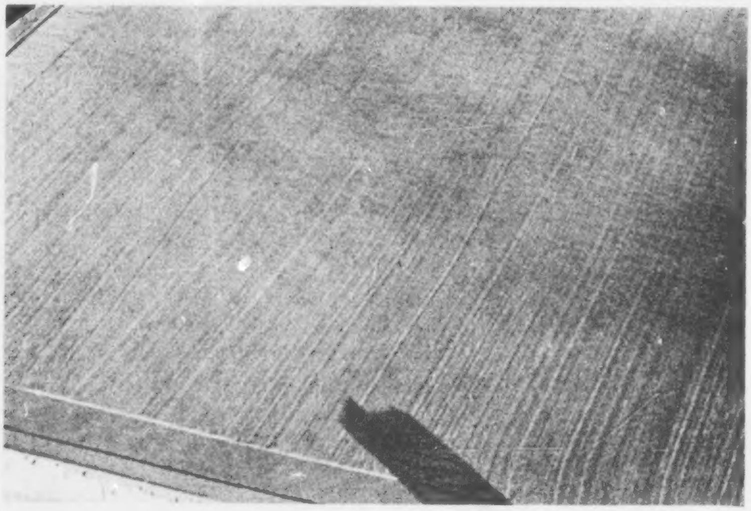
(NOTE: Use same procedure as in previous steps.)

DD. Finish by brooming when entire approach has been floated and/or troweled

(NOTE: Broom pattern is usually specified to be at right angles with direction of travel.)

EE. Start broom finish by swinging broom to center of slab; set down lightly and draw back toward you (Figure 13)

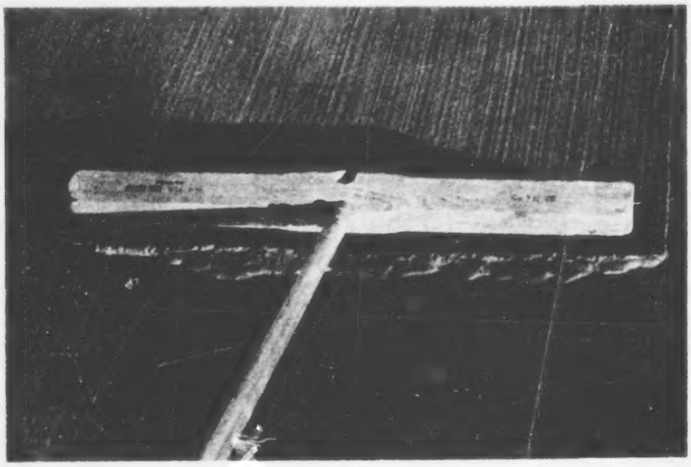
FIGURE 13



JOB SHEET #1

FF. Make each succeeding pass by slightly lapping previous pass (Figure 14)

FIGURE 14



GG. Re-edge all edges and expansion joint when entire slab has been broomed

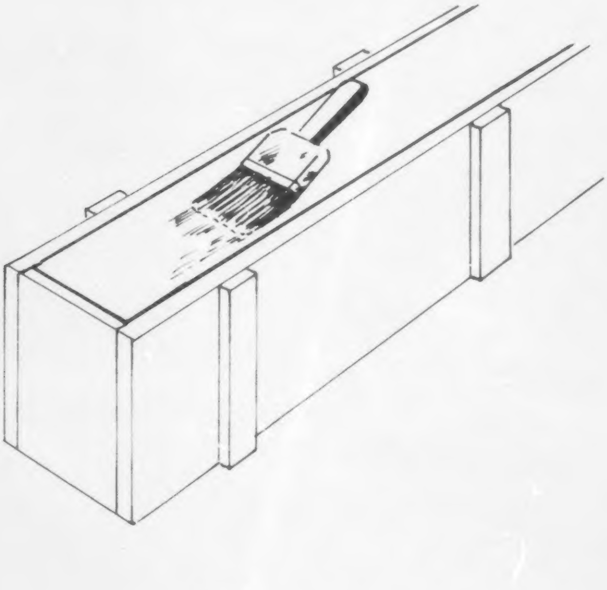
HH. Re-edge curbs using same procedure as before

II. Retrowel surface of curb to take out all edger marks

JJ. Draw fine-haired brush over curb in a lengthwise motion until entire curb is finished (Figure 15)

(NOTE: Bucket of water is used to keep brush cleaned out.)

FIGURE 15



JOB SHEET #1

KK. Remove inside curb form with hammer

LL. Use margin trowel and cork float to place small amount of mud on face of curb and to float into surface until smooth

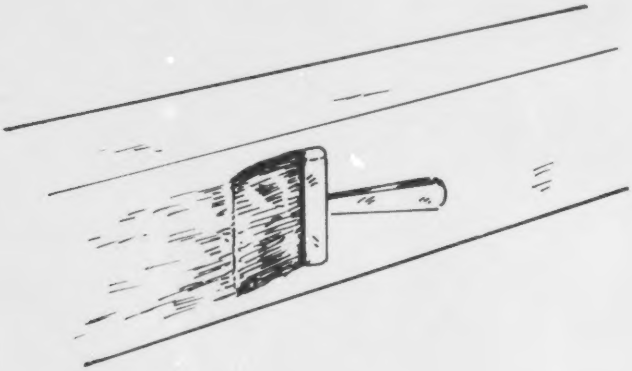
MM. Use midget trowel to trowel face of curb until smooth

NN. Use fine-haired brush to brush face of curb after curb face has been floated and troweled

OO. Tilt brush and draw over face of curb in a lengthwise motion until curb is finished

PP. Follow same procedures as on first curb, remove forms from second curb, and finish face of curb (Figure 16)

FIGURE 16



QQ. Apply curing agent as soon as possible without damaging finish

RR. Use margin trowel, brush, and water to clean all tools and equipment

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

JOB SHEET #2--PLACE AND FINISH ROLL TYPE CURB AND GUTTER

I. Tools and materials

   A. Tools

      1. Straightedge
      2. Hand floats
      3. Trowels
      4. Brush
      5. Margin trowel
      6. Edger, 1/2" radius
      7. Mule
      8. Broom
      9. Sprayer

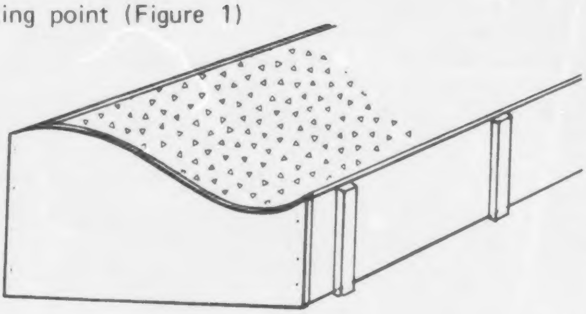
   B. Materials

      1. Concrete
      2. Bucket of water
      3. Curing agent

II. Procedure

   A. Place concrete at starting point (Figure 1)

FIGURE 1

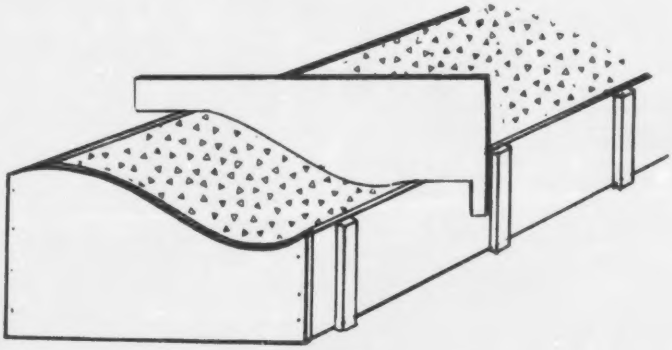


JOB SHEET #2

B. Use mule to rod concrete (Figure 2)

(NOTE: For this type of curb and gutter concrete must be very low slump.)

FIGURE 2



C. Continue pouring and rodding until entire curb is poured

D. Go back to start of pour and use straightedge lengthwise to reach across curb; work straightedge from gutter up and over curb

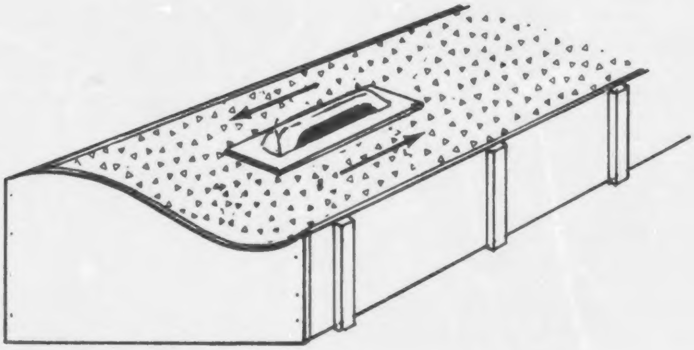
(NOTE: This will help to close up concrete and leave curb and gutter relatively smooth.)

E. Continue this procedure until entire curb and gutter has been straightedged

F. Use float lengthwise with curb and fairly flat to surface; move in a sawlike motion to close up curb, leaving it smooth (Figure 3)

(NOTE: In some areas finishers will also trowel curb and gutter before brooming.)

FIGURE 3



JOB SHEET #2

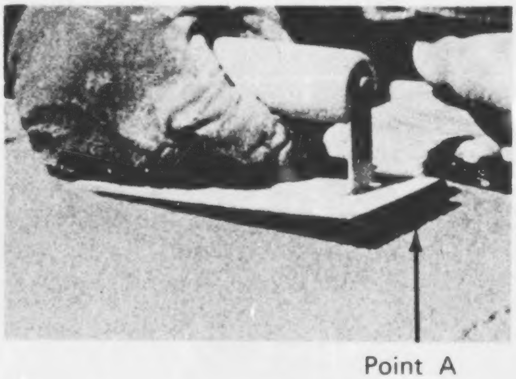
G. Use edger to edge inside of all forms, expansion joints, and division plates

(NOTE: This step is done after curbs and gutters have been layed down.)

H. Tilt point A of edger slightly up and move forward in an arm's length pattern (Figure 4)

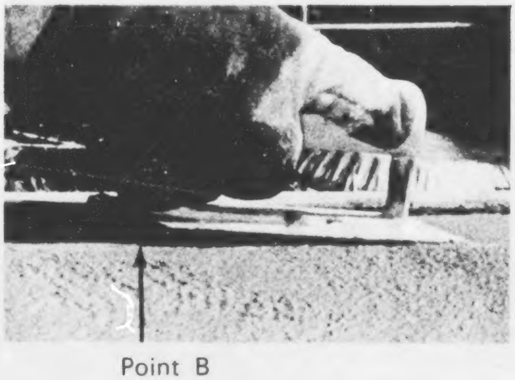
(NOTE: To avoid picking up surface of concrete lift edger only while it is still in motion.)

FIGURE 4



I. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 5)

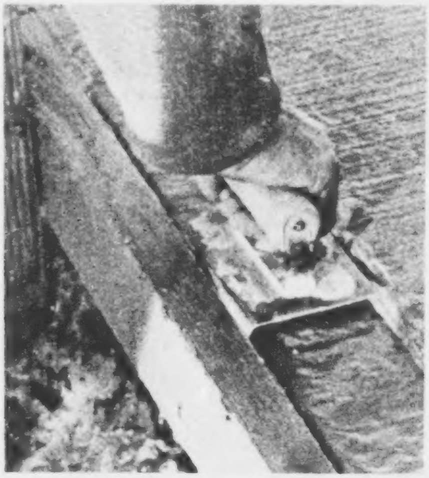
FIGURE 5



JOB SHEET #2

(CAUTION: To avoid low places do not put too much pressure on edger. See Figure 6.)

FIGURE 6



J. Pull plates up and out of concrete after division plates have been edged and if concrete is hard enough

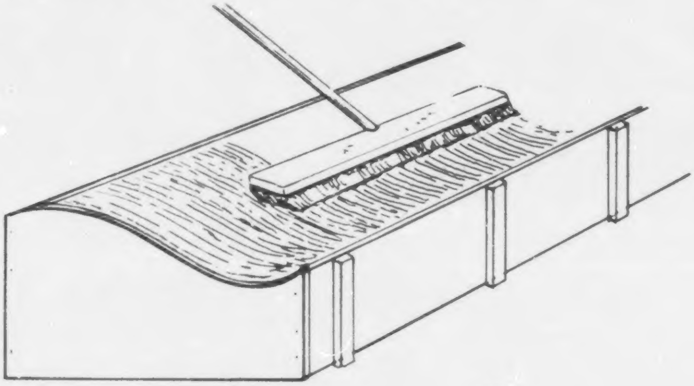
K. Float out all edger marks

L. Use brush or push broom to broom curb or gutter

M. Draw brush or broom across gutter and up and over curb

N. Continue this procedure, lapping previous pass with each succeeding pass until entire curb and gutter has been finished (Figure 7)

FIGURE 7



O. Apply curing agent as soon as possible without damaging finish

P. Use margin trowel, brush, and water to clean tools and equipment

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

JOB SHEET #3--PLACE AND FINISH DRIVE WITH CURBS

I. Tools and materials

A. Tools

1. Straightedge
2. Bullfloat
3. Hand floats
4. Trowels
5. Brush
6. Cork or rubber float
7. Margin trowel
8. Edger, 1/2" radius
9. Edger, 1 1/2" radius
10. Walking edger
11. Burlap
12. Broom
13. Sprayer

B. Materials

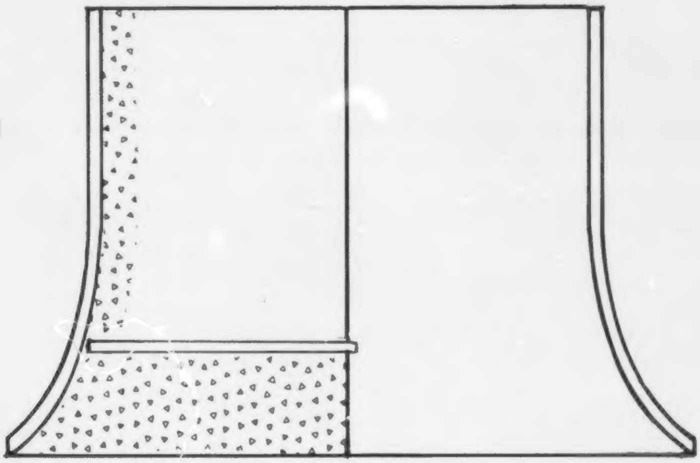
1. Concrete
2. Bucket of water
3. Curing agent
4. Mud (sometimes)

JOB SHEET #3

II. Procedure

A. Place concrete at starting point (Figure 1)

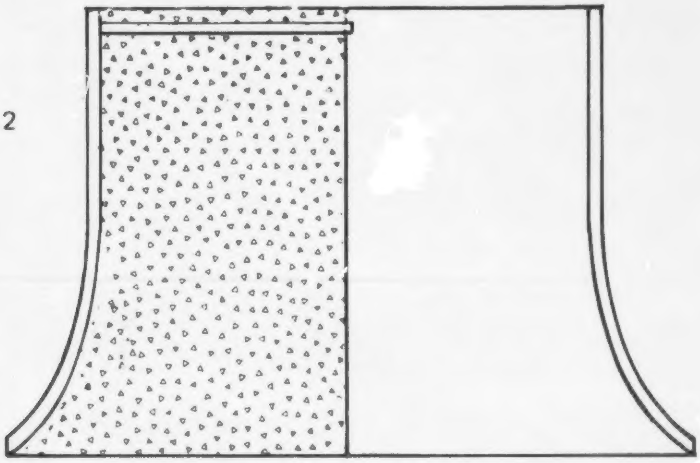
FIGURE 1



B. Use straightedge with sawlike motion to rod concrete (Figure 2)

(CAUTION: Be sure to keep enough concrete behind straightedge to fill holes.)

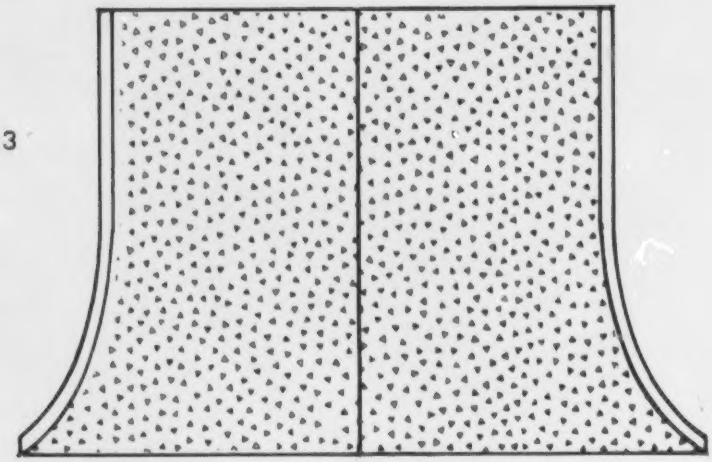
FIGURE 2



JOB SHEET #3

C. Continue straightedging and backing up until drive is poured (Figure 3)

FIGURE 3

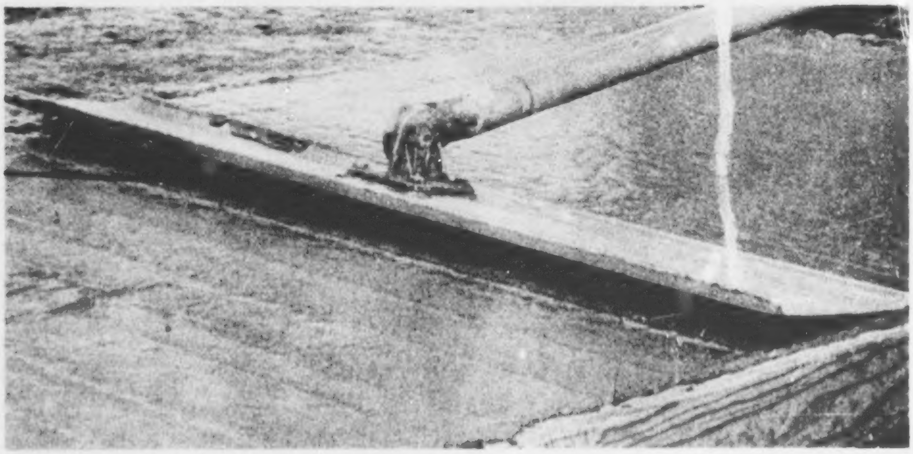


D. Bullfloat surface of drive with a forward and backward movement

(NOTE: This step should be done immediately after straightedging.)

E. Position handle of bullfloat so blade at point A is slightly tilted up on forward motion (Figure 4)

FIGURE 4

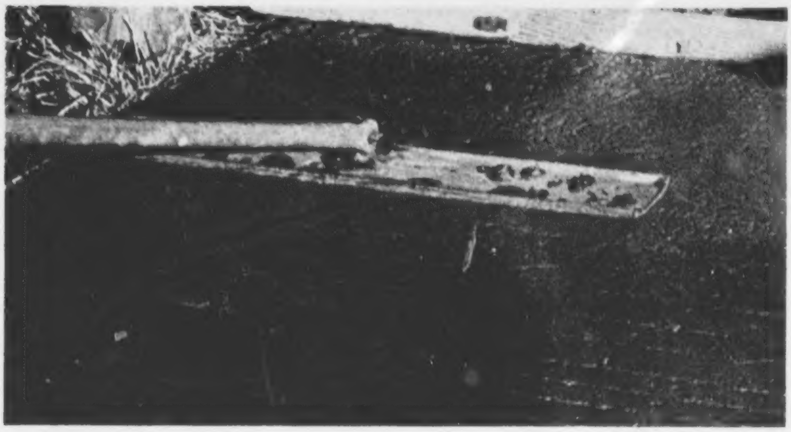


Point A

JOB SHEET #3

F. Position handle of bullfloat so that blade at point B is relatively flat to the surface on backward motion (Figure 5)

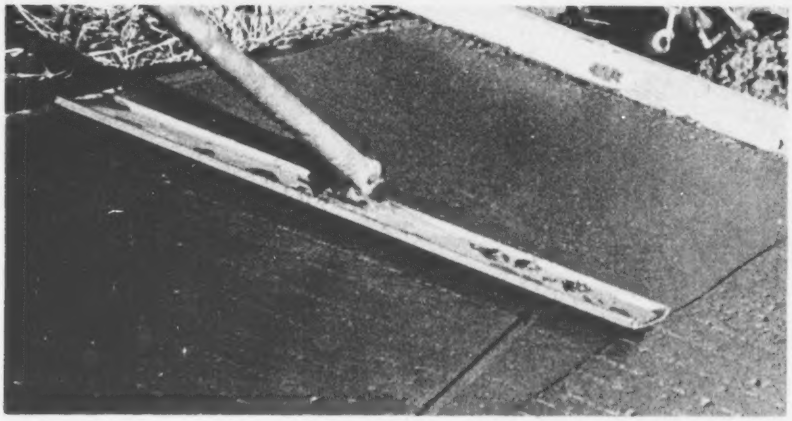
FIGURE 5



Point B

G. Make another pass over first pass; this time the backward motion should be made with the handle positioned so that the blade at point B is slightly raised (Figure 6)

FIGURE 6



Point B

JOB SHEET #3

H. Slightly overlap previous pass and continue process until slab has been floated

I. Fill curbs, starting at beginning of pour

J. Float off curbs flush with top of forms

(NOTE: When curbs are filled and floated, it may be necessary for a time period to elapse before continuing with next step.)

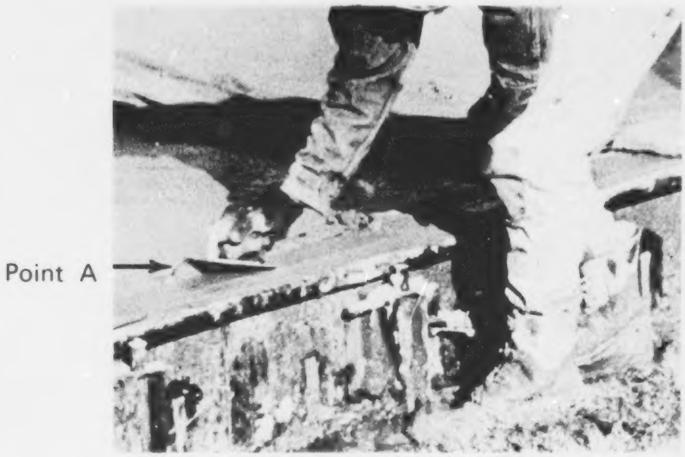
K. Be sure concrete is hard enough to edge front edge of curb with curb edger and rear edge with 1/2" edger

L. Use sidewalk edger to edge rear of curb

M. Tilt point A of edger slightly up and move forward in an arm's length pattern (Figure 7)

(NOTE: To avoid picking up surface of concrete lift edger only while it is still in motion.)

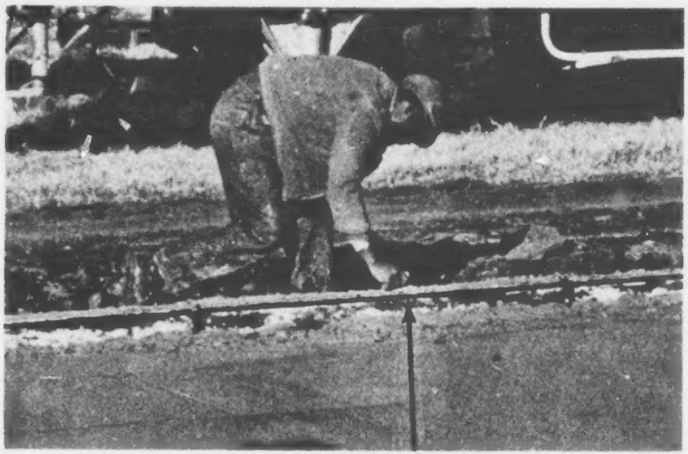
FIGURE 7



JOB SHEET #3

N. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 8)

FIGURE 8



Point B

(CAUTION: To avoid low places do not put too much pressure on edger. See Figure 9.)

FIGURE 9

JOB SHEET #3

O. 'Continue this procedure until all curbs have been rounded and smoothed

P. Use margin trowel or midget trowel to trowel surface of curb and to work out all edger marks

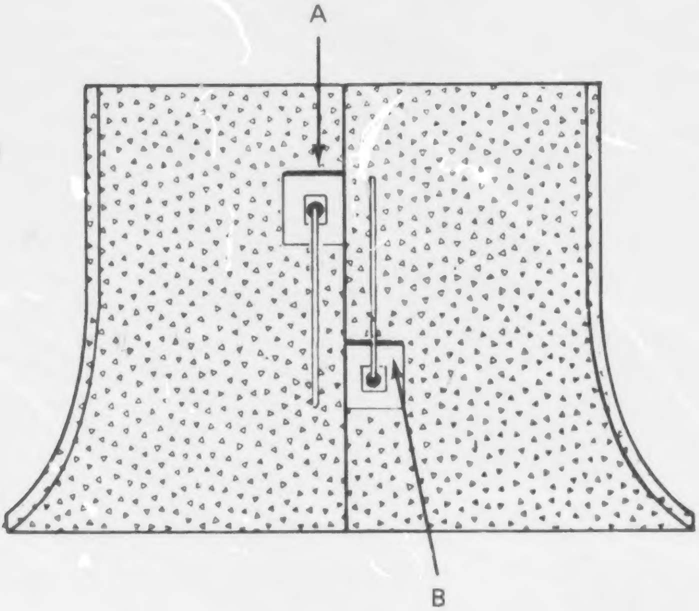
Q. Use walking edger to edge both sides of expansion joints

(NOTE: This step should be done when both curbs have been layed down.)

(CAUTION: Be sure that expansion in curbs line up with expansion in drives.)

R. Push edger across slab with point A of edger slightly tilted up; draw back with point B slightly tilted up (Figure 10)

FIGURE 9

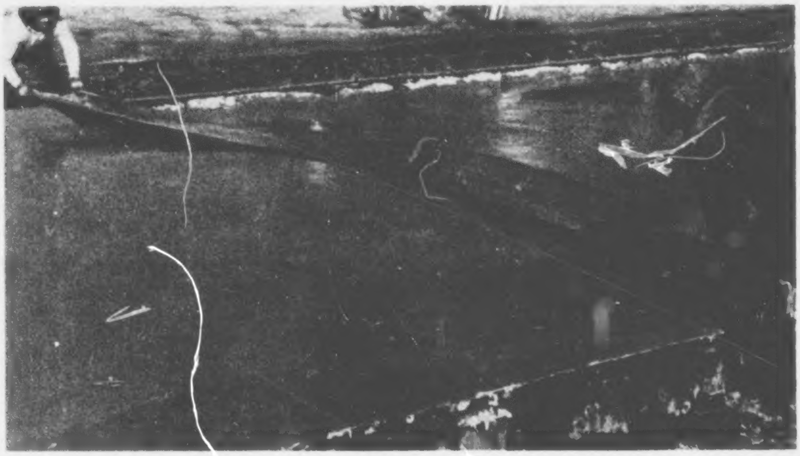


S. Float and trowel slab before applying finish to surface

JOB SHEET #3

T. Be sure concrete is hard enough and then use burlap stretched across slab and pull forward from hardest point to end (Figure 11)

FIGURE 11

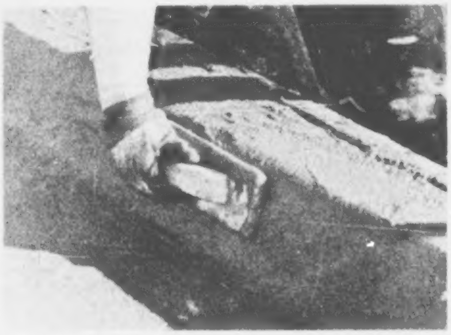


U. Remove inside curb forms

V. Use cork or rubber float lengthwise to float face of curb and to close up holes and to leave curb face relatively smooth (Figure 12)

(NOTE: Sometimes it is necessary to use a little mud to fill in face of curb.)

FIGURE 12



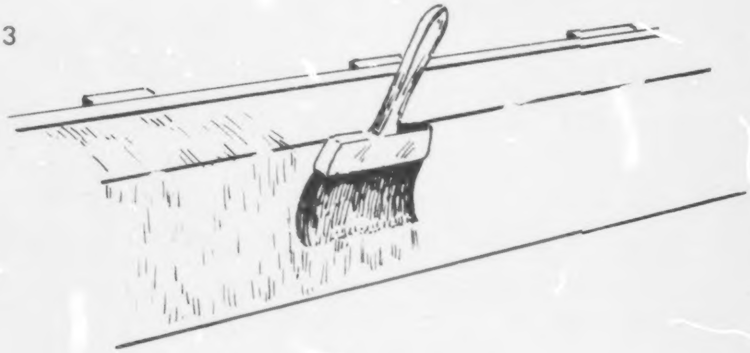
JOB SHEET #3

W. Continue this procedure until all inside forms have been removed and face of curb is relatively smooth

X. Tilt brush slightly and brush up face and over curb

Y. Continue this procedure, lapping each pass until curb is completed (Figure 13)

FIGURE 13



Z. Apply curing agent as soon as possible without damaging finish

AA. Use margin trowel, brush, and water to clean all tools and equipment

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

JOB SHEET #4--PLACE AND FINISH STRAIGHT CURB

I. Tools and materials

A. Tools

1. Hand float
2. Curb edger, 1 1/2" radius
3. Sidewalk edger, 3/8" radius
4. Brush
5. Margin trowel
6. Midget trowel
7. Cork or rubber float
8. Hammer
9. Sprayer

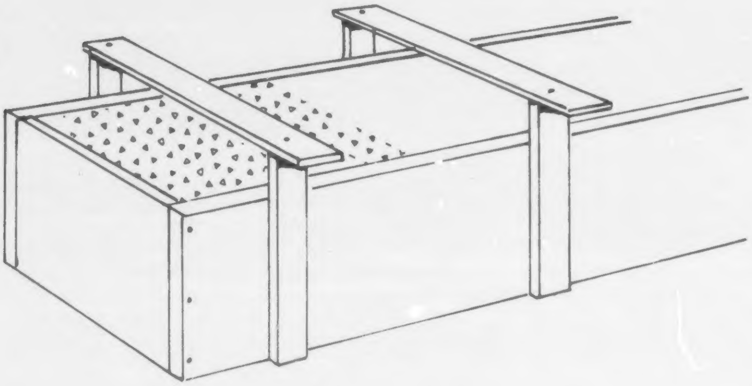
B. Materials

1. Concrete
2. Mud
3. Curing agent

II. Procedure

A. Place concrete at starting point (Figure 1)

FIGURE 1



JOB SHEET #4

B. Continue pouring curb and floating surfaces flush with top of forms until entire curb is poured and floated

(NOTE: It may be necessary for a time period to elapse so that concrete will harden enough to refloat and edge.)

C. Refloat surface of curb

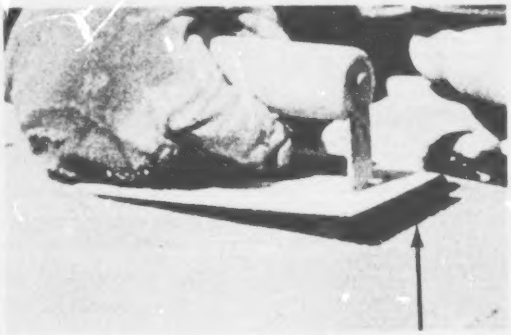
D. Use curb edger to edge inside form

E. Use sidewalk edger to edge outside form

F. Tilt point A of edger slightly up and move forward in an arm's length pattern (Figure 2)

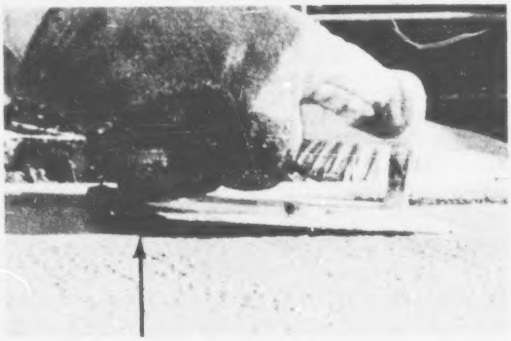
(NOTE: To avoid picking up surface of concrete lift edger only while it is still in motion.)

FIGURE 2



G. Extend edger at arm's length and draw backwards with point B of edger slightly tilted up (Figure 3)

FIGURE 3



JOB SHEET #4

H. Continue this procedure until both edges of curbs have been rounded and smoothed

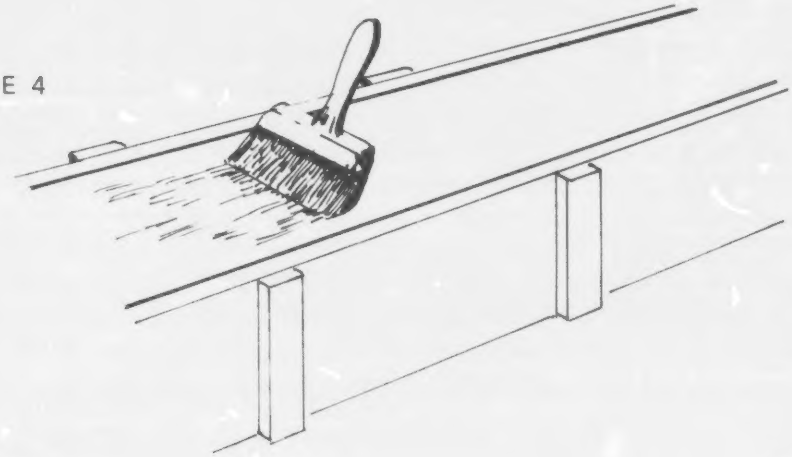
I. Use margin trowel or midget trowel to trowel top surface of curb and to work out edger marks

J. Be sure concrete is hard enough and then remove all cleats using claw hammer

K. Re-edge both sides of curb, using same process as in earlier steps

L. Tilt fine-haired brush and with a lengthwise motion brush top surface very lightly (Figure 4)

FIGURE 4



M. Remove forms with hammer and finish face of curbs

N. Use cork or rubber float and margin trowel, place small amount of mud on face of curb, and float into surface until smooth

O. Use midget or margin trowel to trowel face of curb

P. Use fine-haired brush slightly tilted and draw over face of curb in a lengthwise motion until curb is finished

Q. Follow same procedure to finish other side of curb

R. Apply curing agent using sprayer with nozzle adjusted to a fine mist

S. Use margin trowel, brush, and water to clean all tools and equipment

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Process of rubbing or grinding concrete

______b. Poured concrete floor

______c. Entrance to a drive

______d. Even with

______e. Phrase used for first floating and/or troweling of concrete

______f. Fall or pitch from center to each side

______g. Mixture of sand, cement, and water

______h. Thin steel plate placed between forms to provide full depth joints in a curb and gutter

______i. Fall or pitch from sides to center

______j. Stiff concrete

______k. Fresh concrete that has been set to grade; used to make a screed

______l. Template used to shape the profile of a curb and gutter

______m. Fall or pitch from one side to the other

______n. Preformed piece of compressive material used to separate units of concrete to prevent damage due to expansion

______o. Type of drive used for recreation, such as cookouts, basketball, and shuffleboard

1. Approach
2. Crown
3. Inverted crown
4. Cross slope
5. Recreational drive
6. Mud
7. Flush
8. Wet grade
9. Expansion joint
10. Expansion joint material
11. Low slump
12. Mule
13. Division plate
14. Slab
15. Layed down
16. Rubbing
17. Isolation joint
18. Form oil
19. Battered
20. Curing agent

______p. Isolates one section of concrete from another; isolates concrete from other rigid objects

______q. Type of isolation joint

______r. Receding upward slope at the face of a form or structure

______s. Chemical compound used to prevent evaporation of moisture from concrete

______t. Manufactured product used on forms to prevent adhesion of the concrete to the form

2. Name two types of drives and approaches.

a.

b.

3. Match the types of curbs and curbs and gutters below and on the following page to their proper names. Place the numbers of the correct illustrations in the blanks.

______a. Straight face, vertical

______b. Straight face, battered

______c. Single radius, vertical

______d. Single radius, battered

______e. Double radius, vertical

______f. Double radius, battered

______g. Roll type

______h. Highway gutter

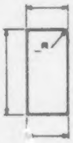
______i. Precast

______j. Straight curb

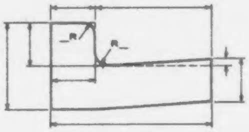
______k. Partially battered curb

______l. Fully battered curb

1.



2.



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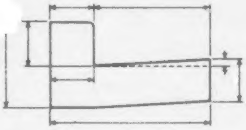
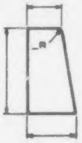
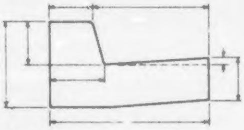


4.



5.



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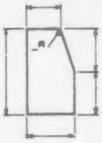
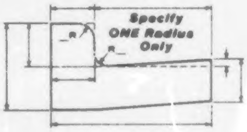


7.



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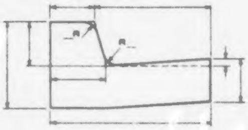
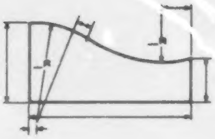
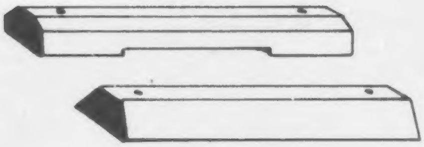


9.



10.



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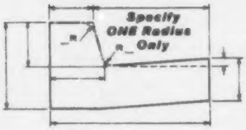
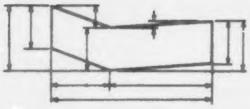


12.

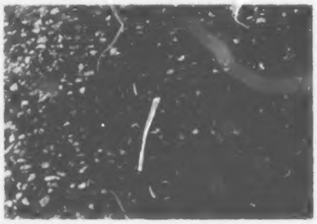


4. Select from the list below three factors to consider before starting an approach. Circle the correct letters.

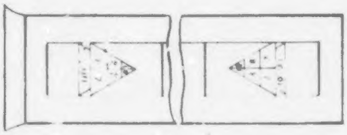
    a. Location
    b. Size
    c. Finish
    d. Design
    e. Amount of concrete
    f. County, city, state, and federal codes and/or ordinances

5. Identify the following types of finishes for residential drives.

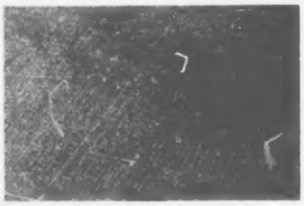
a. ____________________



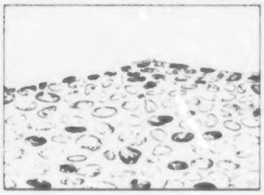
b. ____________________



c. ____________________

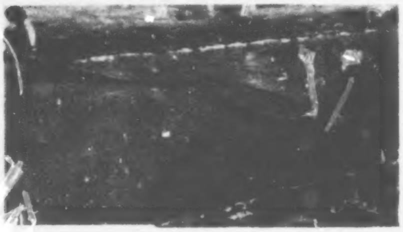


d. ____________________

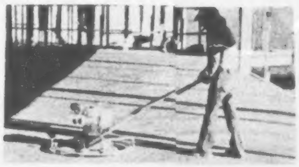


e. ____________________

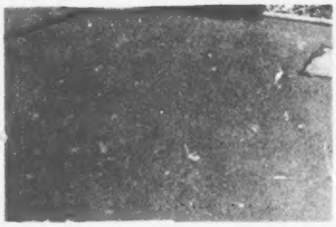
6. Identify the following types of finishes for commercial drives.



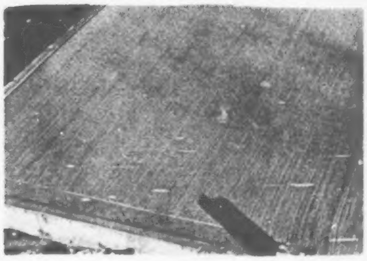
a. ____________________



b. ____________________



c. ____________________



d. ____________________

7. Discuss in a short paragraph concrete thickness variations for drives.

8. Name three methods of drainage for drives.

   a.

   b.

   c.

9. Demonstrate the ability to:

   a. Place and finish approach with curbs.

   b. Place and finish roll type curb and gutter.

   c. Place and finish drive with curbs.

   d. Place and finish straight curb.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

FINISHING CONCRETE DRIVES, APPROACHES, CURBS, AND CURBS AND GUTTERS
UNIT VII

ANSWERS TO TEST

1. a. 16
   b. 14
   c. 1
   d. 7
   e. 15
   f. 2
   g. 6
   h. 13
   i. 3
   j. 11
   k. 8
   l. 12
   m. 4
   n. 10
   o. 5
   p. 17
   q. 9
   r. 19
   s. 20
   t. 18

2. a. Residential
   b. Commercial

3. a. 3
   b. 5
   c. 7
   d. 11
   e. 2
   f. 8
   g. 9
   h. 12
   i. 10
   j. 1
   k. 6
   l. 4

4. b, d, f

5. a. Float
   b. Exposed aggregate
   c. Recreational
   d. Broom
   e. Cobblestone

6. a. Burlap
   b. Machine
   c. Float
   d. Broom
7. Discussion should include the following points.
   a. Residential drives
      1. Four inches minimum
      2. Increased if drive is subjected to heavy truck traffic
   b. Commercial drives
      1. Six inches minimum
      2. Increased to eight inches if drive is subjected to extra heavy traffic
8. a. Crown
   b. Inverted crown
   c. Cross slope
9. Performance skills evaluated to the satisfaction of the instructor

JOINTS IN CONCRETE
UNIT VIII

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify equipment used to cut joints and apply sealants. He should be able to match illustrations of joints and waterstops to their proper names and be able to name elements of joint design. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with joints in concrete to the correct definitions.
2. Match types of joints to their correct names.
3. Name three reasons for joints in pavement.
4. Name three factors to consider when designing joints.
5. Name two elements of joint design in pavement.
6. Select variables to consider when deciding joint location in slabs.
7. Name the factors that affect spacing of joints in slabs.
8. Name types of materials used in joints.
9. Identify types of equipment used to cut joints.
10. Identify types of equipment used to apply sealants.
11. Select from a list types of sealants used in joints.
12. Match basic types of waterstops to their proper names.

JOINTS IN CONCRETE
UNIT VIII

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information sheet.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Contact Portland Cement Association for "Quality Concrete Slide Reference File" and/or films.

  F. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Types of Joints

    2. TM 2--Types of Joints (Continued)

    3. TM 3--Types of Joints (Continued)

    4. TM 4--Crack Patterns

    5. TM 5--Types of Joint-cutting Equipment

6. TM 6--Equipment for Filling Joints

7. TM 7--Basic Types of Waterstops

D. Test

E. Answers to test

II. References:

A. Burke, Arthur E., J. Ralph Dalzell, and Gilbert Townsend. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Brady, George S. *Materials Handbook: An Encyclopedia for Purchasing Managers, Engineers, Executives, and Foremen.* New York: McGraw-Hill Book Company, 1971.

C. *Cement Mason's Guide to Building Concrete Walks, Drives, Patios, and Steps.* Skokie, Illinois: Portland Cement Association, 1973.

III. Films:

A. "Quality Concrete Slide Reference File." Available from Portland Cement Association, Old Orchard Road, Skokie, Illinois 60076.

B. "Resealing Concrete Pavement Joints in Minnesota." Available from Portland Cement Association, Old Orchard Road, Skokie, Illinois 60076.

JOINTS IN CONCRETE
UNIT VIII

INFORMATION SHEET

I. Terms and definitions

   A. Joint--Separation or cut made in concrete for a specific purpose

   B. Isolation joint--Joint to isolate one section of concrete from another and to isolate concrete from other rigid objects

   C. Expansion joint--Type of isolation joint

   D. Control joint--Joint cut into concrete to control and induce cracking at this point rather than at random

   E. Contraction joint--Type of control joint

   F. Construction joint--Planned or emergency joint placed where pour is temporarily suspended

   G. Skewed joint--Control joint placed obliquely across slab or pavement

   H. Longitudinal joint--Joint placed lengthwise in slab or pavement

   I. Transverse joint--Joint placed crosswise in slab or pavement

   J. Doweled contraction joint--Joint spaced to control transverse cracking and load transfer

   K. Dummy joint--Joint placed in sidewalks and patios strictly for design

   L. Tensile stress--Longitudinal stress to which slab is subjected when in tension

   M. Slab--Poured concrete floor

   N. Subgrade--Soil prepared and compacted to support a structure or pavement system

   O. Expansion material--Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

   P. Jointer--Tool used to cut grooves in concrete

   Q. Caulking gun--Gun used to apply caulking materials

   R. Sealant--Sealing agent

   S. Thermoplastic--Material used as a sealant after it has been heated and has become plastic

INFORMATION SHEET

T. Elastomers--Variety of elastic substances resembling rubber

U. Silicone--Polymeric organic silicon compound used as a water resistant sealant

V. Acrylic--Synthetic resin used for formulation of caulks and sealants with very good adhesion and weather resistant properties

W. Polyurethane--Nonstaining, durable, flexible elastomeric polymer compound

X. Mastic--Any of various pasty materials composed of asphalts and nondrying oils

Y. Waterstop--Flexible waterproof material cast in place across a joint in concrete to prevent passage of water

Z. Finger expansion--Steel interlocking type expansion used on bridges

AA. Sliding plate expansion--Steel plate anchored to one section of concrete with another place anchored to other section of concrete placed so that one will overlap and will slide on top of another

II. Types of joints (Transparencies 1, 2, and 3)

A. Tooled isolation joint with capped steel rod

B. Tooled isolation joint held down for sealant

C. Sawed longitudinal joint without keyway

D. Tooled control joint

E. Sawed control joint

F. Tooled construction joint with keyway

G. Tooled construction joint with steel dowel

H. Tooled construction joint with expansion

I. Sawed contraction joint with steel dowel

J. Sawed contraction joint with steel dowel and distributed steel

K. Tooled dummy joint

L. Open joint for filling

M. Decorative joint with wood spacer

INFORMATION SHEET

N. Joint with metal spacer

O. Longitudinal and skewed joints in pavement

P. Finger expansion

Q. Sliding plate expansion

III. Reasons for joints in pavement (Transparency 4)

A. Control transverse and longitudinal cracking

B. Control slab movement

C. Divide pavement into suitable spacings

IV. Factors to consider when designing joints

A. Control cracks

B. Provide adequate load transfer across joints

C. Prevent joints from faulting

V. Elements of joint design in pavement

A. Provide load-carrying capacity

B. Provide riding quality at lowest cost

VI. Variables to consider when deciding joint location in slabs

A. Tensile stress

B. Slab size

C. Vertical movement

D. Different slab thicknesses

VII. Factors that affect spacing of joints in slabs

A. Water content

B. Temperature and humidity changes

C. Subgrade restraint

INFORMATION SHEET

VIII. Types of materials used in joints

- A. Compressible material
- B. Redwood, cypress, and cedar
- C. Plastic
- D. Metal

IX. Types of equipment used to cut joints (Transparency 5)

- A. Gas-driven power saw
- B. Electric power saw
- C. Jointer

X. Equipment used to fill joints (Transparency 6)

- A. Spouted bucket for hot pour
- B. Cartridge type caulking gun
- C. Bulk type caulking gun
- D. Air-powered gun

XI. Types of sealants used in joints

- A. Thermoplastic
- B. Elastomer
- C. Silicone
- D. Acrylic
- E. Polyurethane
- F. Mastic
- G. Lead

XII. Basic types of waterstops (Transparency 7)

- A. Serrated
- B. Serrated dumbbell

INFORMATION SHEET

C. Serrated "V"

D. Cellular

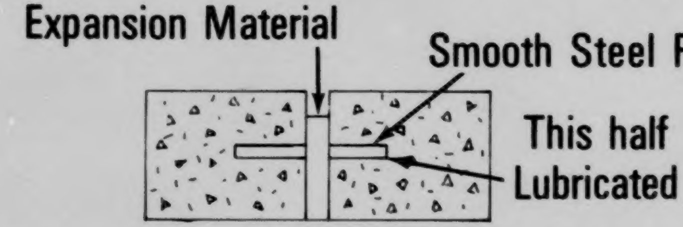
E. Dumbbell

F. Center-bulb dumbbell

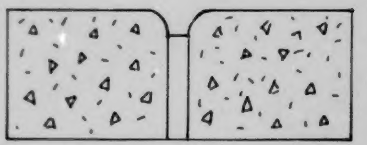
G. On-grade

H. Labyrinth

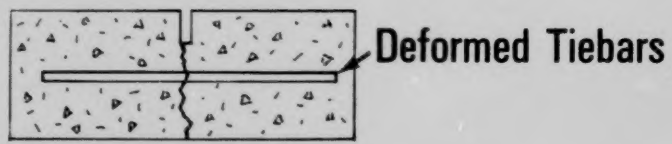
Types of Joints


Expansion Material
Smooth Steel Rod
This half
Lubricated

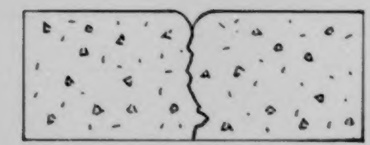
Tooled Isolation Joint
with Capped Steel Rod



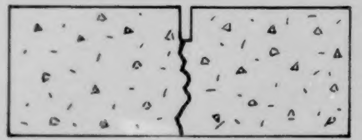
Tooled Isolation Joint
Held Down for Sealant


Deformed Tiebars

Sawed Longitudinal
Joint without Keyway



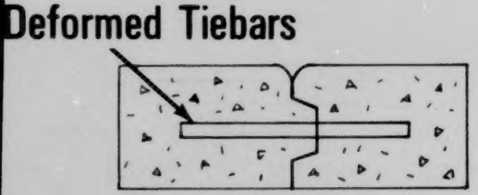
Tooled Control Joint



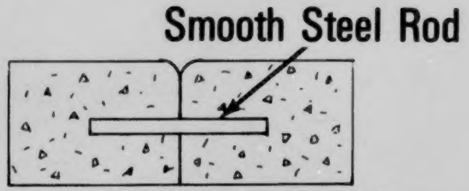
Sawed Control Joint

Types of Joints

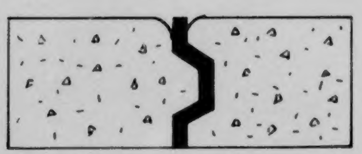
(Continued)


Deformed Tiebars

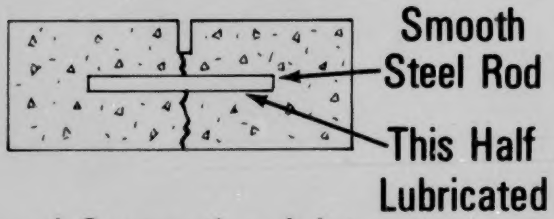
Tooled Construction Joint with Keyway


Smooth Steel Rod

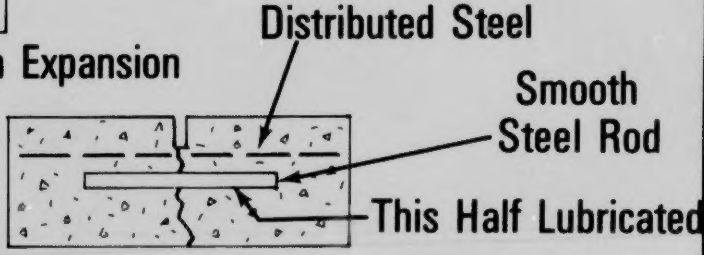
Tooled Construction Joint with Steel Dowel



Tooled Construction Joint with Expansion


Smooth
Steel Rod
This Half
Lubricated

Sawed Contraction Joint with Steel Dowel

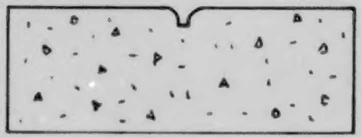

Distributed Steel
Smooth
Steel Rod
This Half Lubricated

Sawed Contraction Joint with Steel Dowel and Distributed Steel

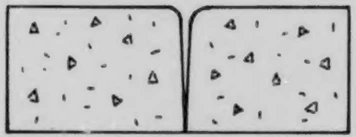
723

Types of Joints

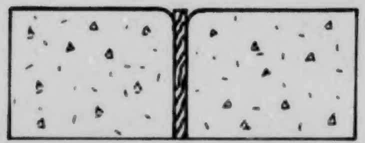
(Continued)



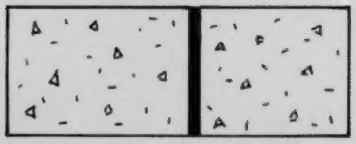
Tooled Dummy Joint



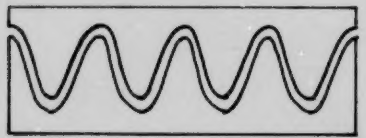
Open Joint for Filling



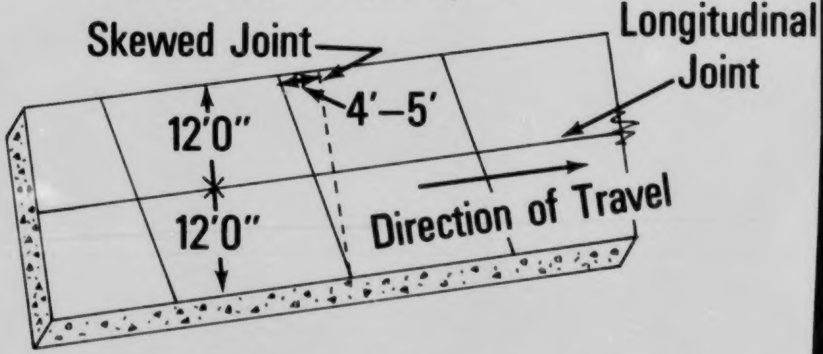
Decorative Joint with Wood Spacer



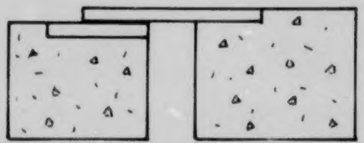
Joint with Metal Spacer



Finger Expansion

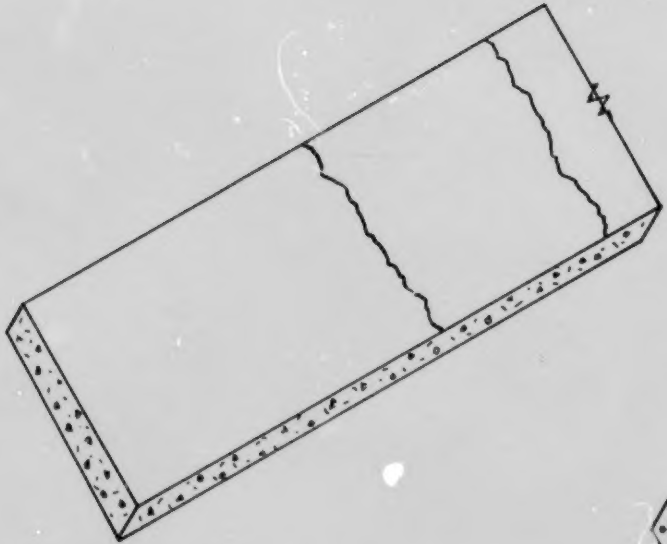

Skewed Joint
Longitudinal Joint
4'–5'
12'0"
12'0"
Direction of Travel

Longitudinal and Skewed Joints in Pavement

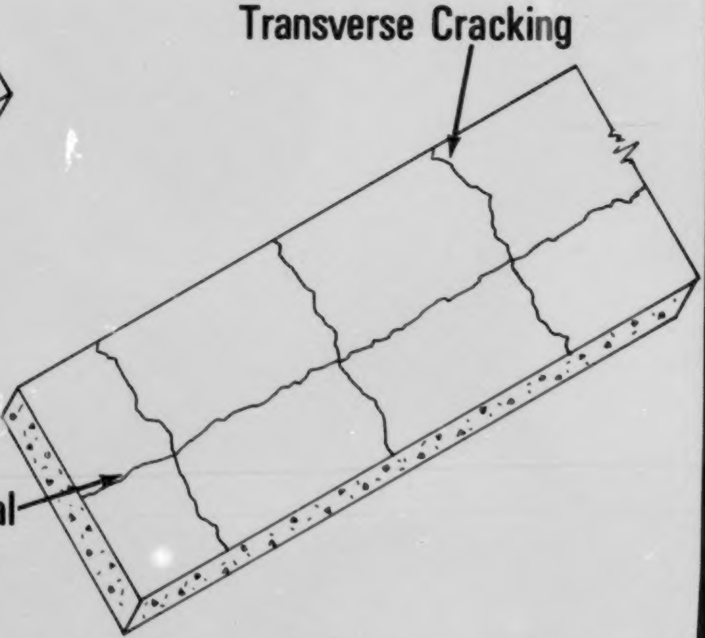


Sliding Plate Expansion

Crack Patterns



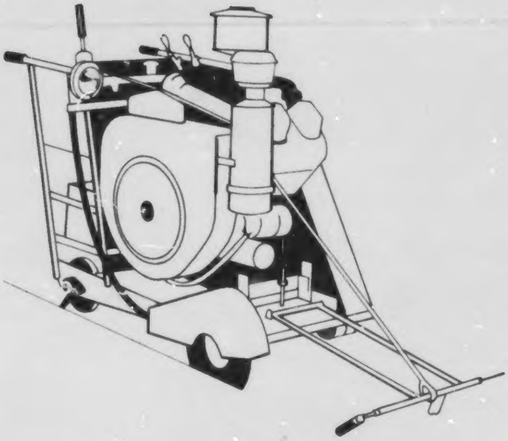
Cracks Caused
by Restrained Contraction



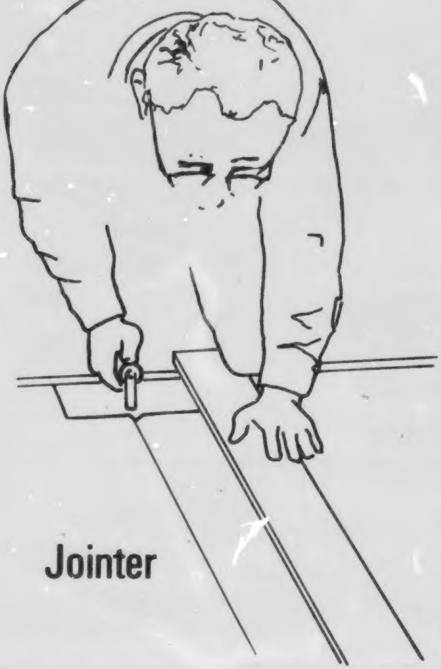
Transverse Cracking
Longitudinal Cracking

Cracks Caused by Restrained Warping
Stresses Acting in Combination with Loads

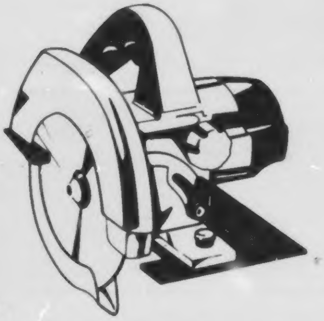
Types of Joint-Cutting Equipment



Gas-Driven Power Saw

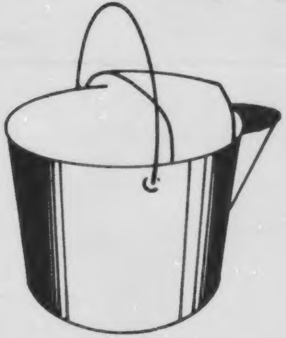


Jointer

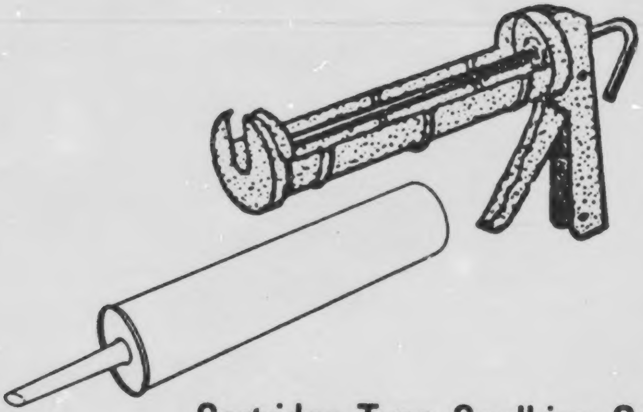


Electric Power Saw

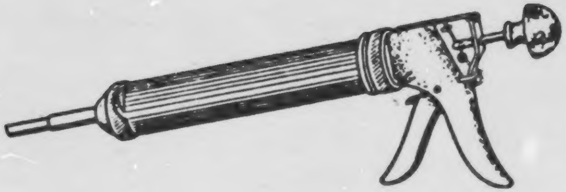
Equipment for Filling Joints



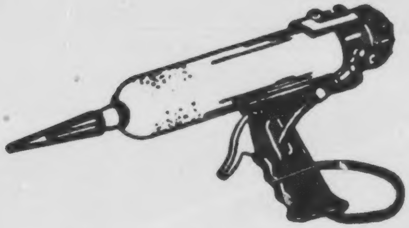
Spouted Bucket
for Hot Pour



Cartridge Type Caulking Gun

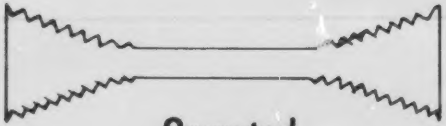


Bulk Type Caulking Gun

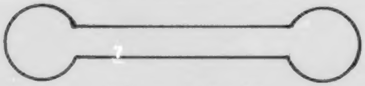


Air-Powered Gun

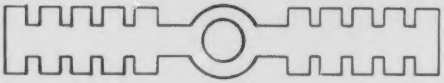
Basic Types of Waterstops



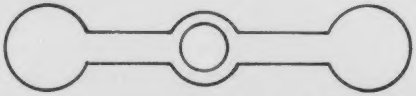
Serrated



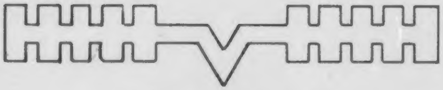
Dumbbell



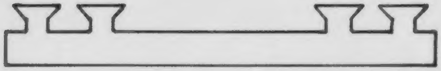
Serrated Dumbbell



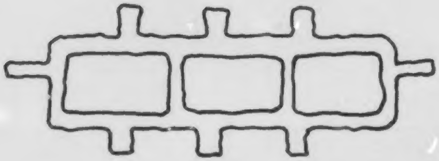
Center-Bulb Dumbbell



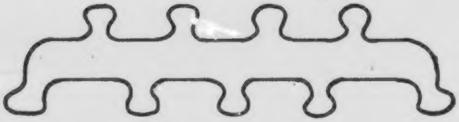
Serrated "V"



On-Grade



Cellular



Labyrinth

JOINTS IN CONCRETE
UNIT VIII

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. (Terms and definitions are continued on next page.)

______a. Any of various pasty materials composed of asphalts and nondrying oils

______b. Gun used to apply caulking materials

______c. Polymeric organic silicon compound used as a water resistant sealant

______d. Nonstaining, durable, flexible, elastomeric polymer compound

______e. Sealing agent

______f. Variety of elastic substances resembling rubber

______g. Synthetic resin used for formulation of caulks and sealants with very good adhesion and weather resistant properties

______h. Material used as a sealant after it has been heated and has become plastic

______i. Tool used to cut grooves in concrete

______j. Joint placed in sidewalks and patios strictly for design

______k. Separation or cut made in concrete for a specific purpose

______l. Joint spaced to control transverse cracking and load transfer

______m. Preformed piece of compressible material used to separate units of concrete to prevent damage due to expansion

1. Joint
2. Isolation joint
3. Expansion joint
4. Control joint
5. Contraction joint
6. Construction joint
7. Skewed joint
8. Longitudinal joint
9. Transverse joint
10. Doweled contraction joint
11. Dummy joint
12. Tensile stress
13. Slab
14. Subgrade
15. Expansion material
16. Jointer
17. Caulking gun
18. Sealant
19. Thermoplastic
20. Elastomers

______n. Joint to isolate one section of concrete from another and to isolate concrete from other rigid objects

______o. Soil prepared and compacted to support a structure or pavement system

______p. Joint placed crosswise in slab or pavement

______q. Type of isolation joint

______r. Joint placed lengthwise in slab or pavement

______s. Poured concrete floor

______t. Joint cut into concrete to control and induce cracking at this point rather than at random

______u. Control joint placed obliquely across slab or pavement

______v. Type of control joint

______w. Planned or emergency joint placed where pour is temporarily suspended

______x. Longitudinal stress to which slab is subjected when in tension

______y. Flexible waterproof material cast in place across a joint in concrete to prevent passage of water

______z. Steel plate anchored to one section of concrete with another plate anchored to other section of concrete placed so that one overlaps and will slide on top of another

_____aa. Steel interlocking type expansion used on bridges

21. Silicone
22. Acrylic
23. Polyurethane
24. Mastic
25. Sliding plate expansion
26. Waterstop
27. Finger expansion

2. Match the types of joints illustrated below and on the following page to the correct names. Place the appropriate numbers in the blanks provided.

______a. Sawed control joint

______b. Tooled construction joint with keyway

______c. Sawed longitudinal joint without keyway

______d. Tooled isolation joint with capped steel rod

______e. Sawed contraction joint with steel dowel

______f. Sawed contraction joint with steel dowel and distributed steel

______g. Tooled construction joint with steel dowel

______h. Tooled isolation joint held down for sealant

______i. Tooled control joint

______j. Tooled construction joint with expansion

______k. Tooled dummy joint

______l. Decorative joint with wood spacer

______m. Open joint for filling

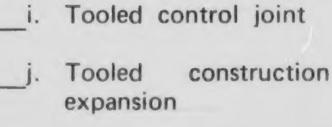
______n. Joint with metal spacer

______o. Longitudinal and skewed joints in pavement

______p. Finger expansion

______q. Sliding plate expansion

1.



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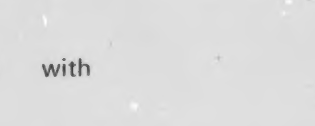

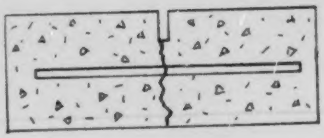
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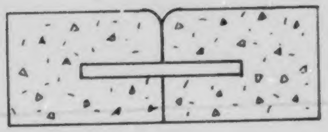
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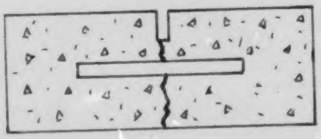
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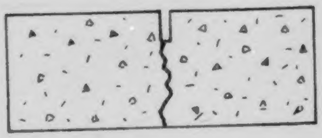
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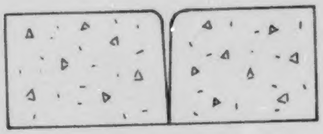
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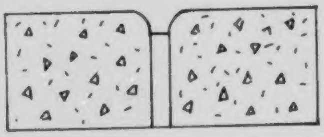
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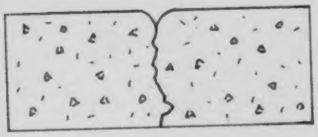
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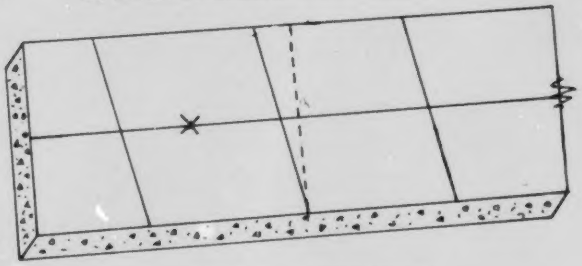
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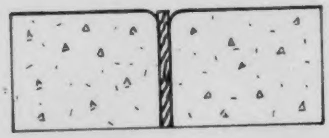
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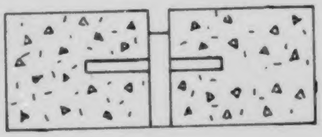
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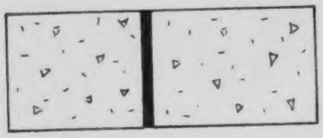
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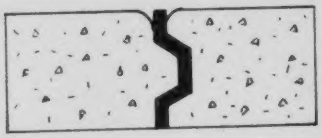
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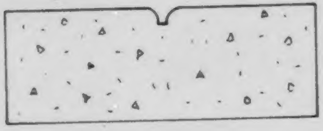
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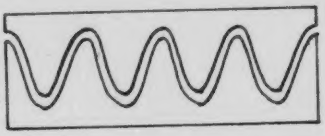
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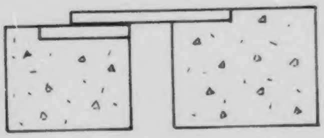

17.

3. Name three reasons for joints in pavement.

   a.

   b.

   c.

4. Name three factors to consider when designing joints.

   a.

   b.

   c.

5. Name two elements of joint design in pavement.

   a.

   b.

6. Select from the list below four variables to consider when deciding joint location in slabs. Circle the correct letters.

   a. Compressive strength

   b. Slab size

   c. Slump of concrete

   d. Bonding strength

   e. Vertical movement

   f. Tensile stress

   g. Type of sealant used

   h. Different slab thicknesses

7. Name two factors that affect spacing of joints in slabs.

   a.

   b.

8. Name the types of materials used in joints.

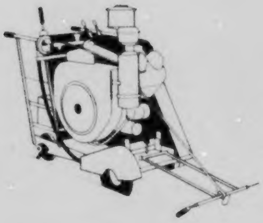
   a.

   b.

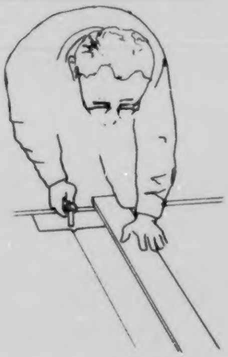
   c.

   d.

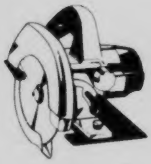
9. Identify the types of equipment used to cut joints by writing the names in the blanks.



a. ____________________

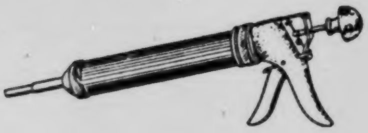


c. ____________________

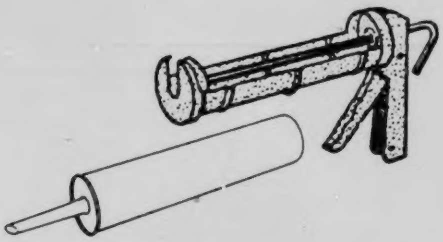


b. ____________________

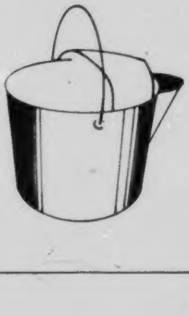
10. Identify types of equipment used to fill joints. Write the correct names in the blanks provided.



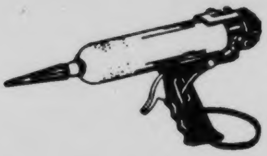
a. ____________________



c. ____________________



b. ____________________



d. ____________________

11. Select from the list below the types of sealants used in joints. Place an "X" in appropriate blanks.

_____a. Mastical

_____b. Acrylic

_____c. Monomolecular

_____d. Polyurethane

_____e. Acrylic resins

_____f. Elastomer

_____g. Mastic

_____h. Silicone

_____i. Air-entrained

_____j. Silica

_____k. Thermoplastic

_____l. Epoxy

_____m. Lead

_____n. Solder

12. Match the types of waterstops illustrated on the right to the correct names on the left. Place the appropriate numbers in the blanks provided.

_____a. Serrated

_____b. Serrated dumbbell

_____c. Serrated "V"

_____d. Cellular

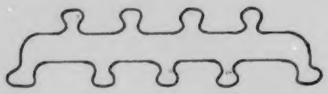
_____e. Dumbbell

_____f. Center-bulb dumbbell

_____g. On-grade

_____h. Labyrinth

1.



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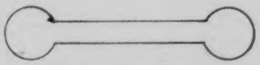

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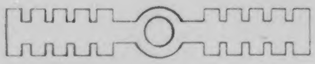

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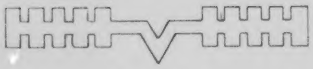

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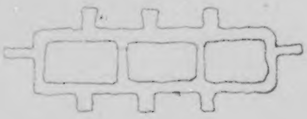

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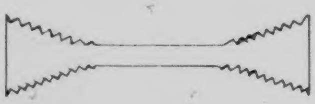

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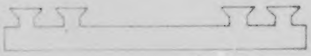

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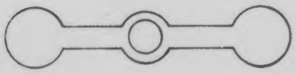


JOINTS IN CONCRETE
UNIT VIII

ANSWERS TO TEST

1. a. 24
   b. 17
   c. 21
   d. 23
   e. 18
   f. 20
   g. 22
   h. 19
   i. 16
   j. 11
   k. 1
   l. 10
   m. 15
   n. 2
   o. 14
   p. 9
   q. 3
   r. 8
   s. 13
   t. 4
   u. 7
   v. 5
   w. 6
   x. 12
   y. 26
   z. 25
   aa. 27
2. a. 6
   b. 1
   c. 3
   d. 12
   e. 5
   f. 2
   g. 4
   h. 8
   i. 9
   j. 14
   k. 15
   l. 11
   m. 7
   n. 13
   o. 10
   p. 16
   q. 17
3. a. Control transverse and longitudinal cracking
   b. Control slab movement
   c. Divide pavement into suitable spacings
4. a. Control cracks
   b. Provide adequate load transfer across joints
   c. Prevent joints from faulting
5. a. Provide load-carrying capacity
   b. Provide riding quality at lowest cost
6. b, e, f, h

7. Any two of the following are acceptable.
   a. Water content
   b. Temperature and humidity changes
   c. Subgrade restraint

8. a. Redwood, cypress, and cedar
   b. Metal
   c. Compressible material
   d. Plastic

9. a. Gas-driven power saw
   b. Electric power saw
   c. Jointer

10. a. Bulk type caulking gun
    b. Spouted bucket for hot pour
    c. Cartridge type caulking gun
    d. Air-powered gun

11. b, d, f, g, h, k, m

12. a. 6
    b. 3
    c. 4
    d. 5
    e. 2
    f. 8
    g. 7
    h. 1

CONCRETE BASES
UNIT IX

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name the two types of bases and the main reason for installing them. He should be able to name the size of a standard cove base and select the maximum height of a base. He should be able to identify base tools and demonstrate the ability to run a straight base and a cove base. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with concrete bases to the proper definitions.
2. Name two types of bases.
3. Explain in a few words what is meant by the cove of a base.
4. Identify base tools.
5. List the reasons for installing bases.
6. Select from a list the sizes of coves that can be installed on a base.
7. State the standard size of a cove.
8. Demonstrate the ability to:
    a. Run a straight base.
    b. Run a cove base.

CONCRETE BASES
UNIT IX

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet.

   C. Make transparency.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency master: TM 1--Base Tools

   D. Job sheets

      1. Job Sheet #1--Run a Straight Base

      2. Job Sheet #2--Run a Cove Base

- E. Test
- F. Answers to test

II. Reference--Rafferty, Max. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1968.

CONCRETE BASES
UNIT IX

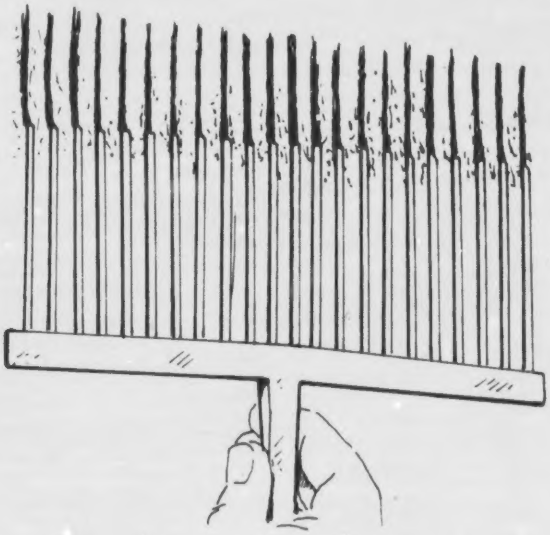
INFORMATION SHEET

I. Terms and definitions

- A. Cove--Concave or radius at bottom section of base
- B. Base--Lower section of a wall
- C. Bonding agent--Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface
- D. Scratch coat--First coat of mud put on base

  (NOTE: Scratch coat could also be the second coat if base is thick enough to require three coats.)
- E. Mud--Mixture of sand, cement, and water
- F. Template--Guide used to shape profile of base
- G. Grounds--Screed and/or divider strip at top edge of base
- H. Combination cove/base tool--Tool used to run cove and base
- I. Scarifier--Tool with several prongs used to scratch surface of concrete and leave it with a rough, raked surface

  Example:



INFORMATION SHEET

II. Types of bases

  A. Cove base

  B. Straight base

III. Cove of a base--Concave or radius at bottom section of base

IV. Base tools (Transparency 1)

  1. Combination cove/base tool

  2. Spoon

V. Reasons for installing bases

  A. To protect walls from dampness

  B. Sanitation

  C. Ease of maintenance

  D. Beauty

VI. Sizes of coves that can be installed on a base

  A. One quarter inch

  B. One half inch

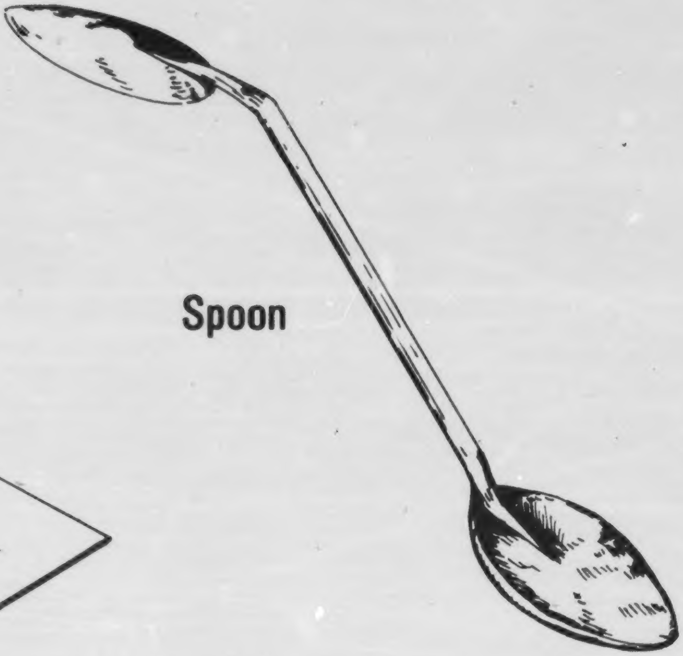
  C. Three quarter inch

  D. One inch

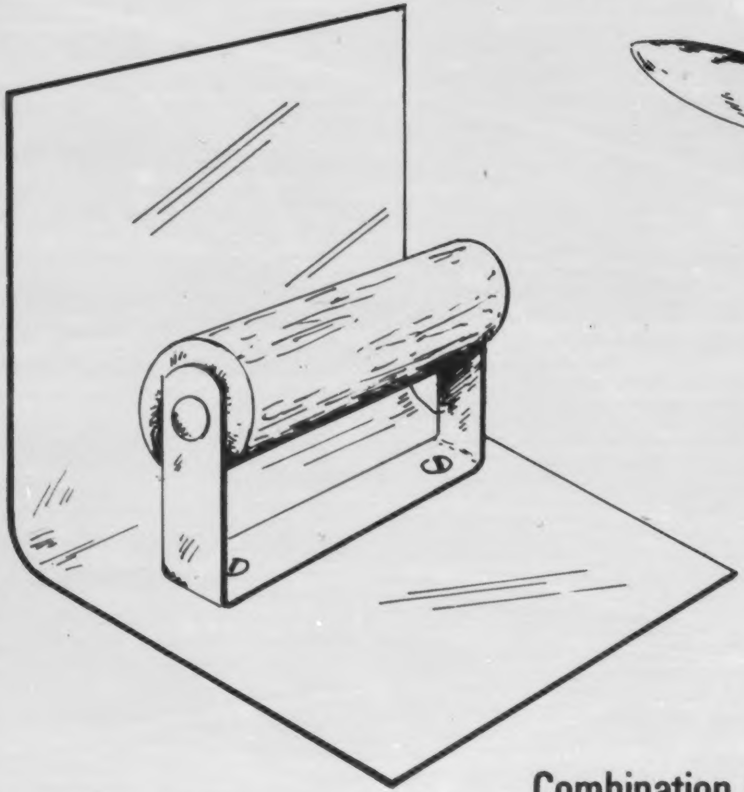
  (NOTE: Size is referring to radius.)

VII. Standard cove size--Three quarters of an inch

Base Tools



Spoon



Combination Cove/Base Tool

CONCRETE BASES
UNIT IX

JOB SHEET #1--RUN A STRAIGHT BASE

I. Tools and materials

A. Tools

1. Margin trowel
2. Short finishing trowel
3. Cork float
4. Edger, 1/4" radius
5. Template
6. Brush
7. Scarifier

B. Materials

1. Mud
2. Bucket of water
3. Bonding agent

II. Procedure

A. Use brush to paint bonding agent on base

(NOTE: Follow manufacturer's specifications.)

B. Use small trowel to apply scratch coat of mud on base; work mud so that it will be held back one-quarter to one-half inch from face of grounds

C. Drag template across face of base to check proper depth, filling in where necessary

D. Continue this procedure until all of base has been scratched in

(NOTE: If finish coat is not to be put on the same day, the surface of scratch coat should be scratched with a scarifier or other suitable tool.)

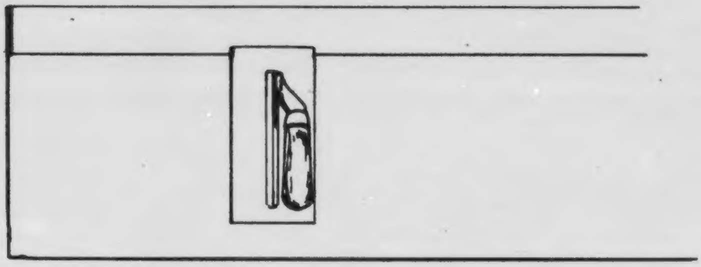
JOB SHEET #1

E. Proceed with finish coat if scratch coat is hard enough

(CAUTION: If scratch coat has gotten too hard, it will be necessary to dampen surface with brush and water before proceeding.)

F. Use small trowel to apply mud, this time filling out to face of grounds (Figure 1)

FIGURE 1



(NOTE: Mud in only the area that can be reached from one position.)

G. Use cork float in a circular motion to float face of base until it is relatively smooth and flat

H. Edge across top edge of base, moving edger in a back and forth movement

I. Trowel surface of base until relatively smooth

J. Move forward and continue procedures until all of base has been finished for the first time

(NOTE: It may be necessary to wait for concrete to harden before continuing to next steps.)

K. Re-edge and retrowel base if base is hard enough

L. Tilt fine-haired brush and with a lengthwise motion, brush face of base very lightly

M. Apply curing agent as soon as possible without damaging finish

CONCRETE BASES
UNIT IX

JOB SHEET #2--RUN A COVE BASE

I. Tools and materials

  A. Tools

    1. Margin trowel
    2. Short finishing trowel
    3. Cork float
    4. Template
    5. Edger, 1/4" radius
    6. Combination cove/base tool, 3/4" radius
    7. Spoon
    8. Brush

  B. Materials

    1. Mud
    2. Bucket of water
    3. Bonding agent

II. Procedure

  A. Use brush to paint bonding agent on base

  (NOTE: Follow manufacturer's specifications.)

  B. Use small trowel to apply scratch coat of mud on base; work mud so that it will be held back one-quarter to one-half inch from face of grounds

  C. Drag template across face of base to check proper depth, filling in where necessary

  D. Continue this procedure until all of base has been scratched in

  (NOTE: If finish coat is not to be put on the same day, the surface of scratch coat should be scratched with a scarifier or other suitable tool.)

JOB SHEET #2

E. Proceed with finish coat if scratch coat is hard enough

(CAUTION: If scratch coat has gotten too hard, it will be necessary to dampen surface with brush and water before proceeding.)

F. Use small trowel to apply mud, this time filling out to face of grounds

(NOTE: Mud in only the area that can be reached from one position.)

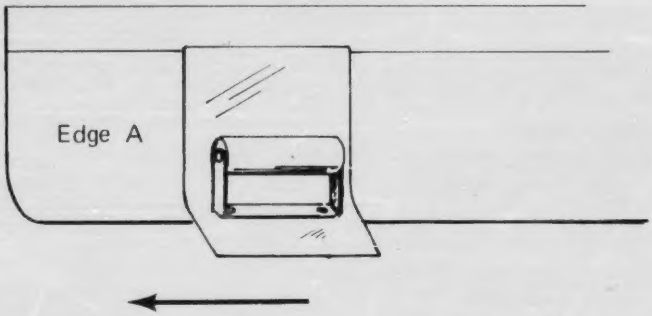
G. Use cork float in a circular motion to float surface until base is relatively smooth and flat

H. Edge across top edge of base, moving edger in a back and forth motion

I. Trowel face of base until relatively smooth

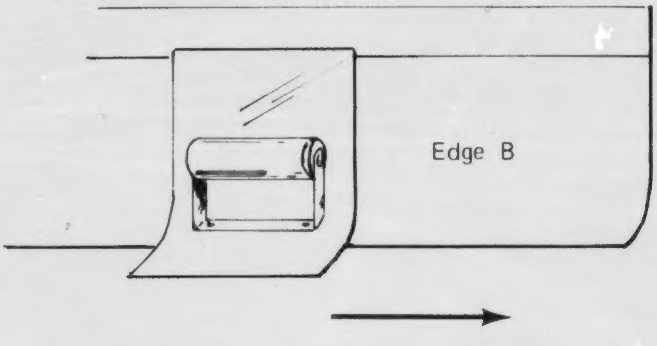
J. Use base tool to work back and forth across base, tilting edge A of base tool out and up slightly as you move forward (Figure 1)

FIGURE 1



K. Tilt edge B of base tool slightly out and up on backward motion (Figure 2)

FIGURE 2



JOB SHEET #2

L. Move base tool back and forth and finish base until relatively smooth

M. Move forward and continue procedure until corner has been reached

N. Use spoon to work out the corner since base tool will not fit tightly into corner

O. Continue procedures until base has been finished for the first time

(NOTE: It may be necessary to wait for concrete to harden before continuing to next steps.)

P. Re-edge, rerun base tool, and retrowel base if base is hard enough

(NOTE: Use same procedure as above.)

Q. Tilt fine-haired brush and with a lengthwise motion brush face of base very lightly

R. Apply curing agent as soon as possible without damaging finish

CONCRETE BASES
UNIT IX

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks.

_____a. Mixture of sand, cement, and water

_____b. Tool used to run cove and base

_____c. Concave or radius at bottom section of base

_____d. Guide used to shape profile of base

_____e. First coat of mud put on base

_____f. Screed and/or divider strip at top edge of base

_____g. Lower section of a wall

_____h. Tool with several prongs used to scratch surface of concrete and leave it with a rough, raked surface

_____i. Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

1. Cove
2. Base
3. Bonding agent
4. Scratch coat
5. Mud
6. Template
7. Grounds
8. Combination cove/base tool
9. Scarifier

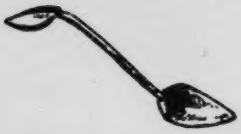
2. Name two types of bases.

a.

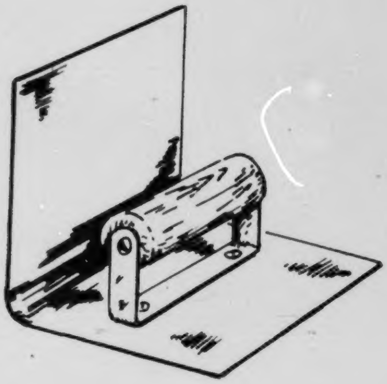
b.

3. Explain in a few words what is meant by the cove of a base.

4. Identify the base tools illustrated below.



a. ______________________



b. ______________________________

5. List the reasons for installing bases.

   a.

   b.

   c.

   d.

6. Select from the list below the sizes of coves that can be installed on a base. Circle the correct letters.

   a. One quarter foot
   b. One inch
   c. One eighth inch
   d. One quarter inch
   e. Three eighth inch
   f. One and one quarter inch
   g. One half inch
   h. Three quarter inch

7. State the standard size of a cove.

8. Demonstrate the ability to:

   a. Run a straight base.

   b. Run a cove base.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

CONCRETE BASES
UNIT IX

ANSWERS TO TEST

1. a. 5
   b. 8
   c. 1
   d. 6
   e. 4
   f. 7
   g. 2
   h. 9
   i. 3
2. a. Cove base
   b. Straight base
3. Concave or radius at bottom section of base
4. a. Spoon
   b. Combination cove/base tool
5. a. To protect walls from dampness
   b. Sanitation
   c. Ease of maintenance
   d. Beauty
6. b, d, g, h
7. Three quarters of an inch
8. Performance skills evaluated to the satisfaction of the instructor

TILT-UP, PRECAST, AND LIFT SLABS
UNIT X

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to discuss tilt-up, precast, and lift-slab construction. He should be able to state the reasons these construction methods are used and what jobs the cement mason does in these types of construction. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with tilt-up, precast, and lift slabs to the proper definitions.
2. Discuss tilt-up construction.
3. Name the reasons for using tilt-up construction.
4. Select from a list jobs done by cement masons in tilt-up construction.
5. Select from a list the most critical stage of tilt-up construction.
6. Define precast concrete.
7. Name the main reasons for using precast units.
8. Define lift slab.
9. Name the advantages of using lift-slab construction.

TILT-UP, PRECAST, AND LIFT SLABS
UNIT X

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide each student with objective sheet.

  B. Provide each student with information sheet.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Contact Portland Cement Association for slides and movies illustrating suitable visual aids in relation to tilt-up, precast, and lift slabs. The film "Broadway Two" is especially useful.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Tilt-Up Construction

    2. TM 2--Critical Stage of Tilt-Up Construction

    3. TM 3--Precast Plant

    4. TM 4--Lift-Slab Construction

D. Test

E. Answers to test

II. References:

A. Taylor, W.H. *Concrete Technology and Practice:* Sydney, Australia: Halstead Press, 1967.

B. Riles, Wilson. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1972.

C. *Concrete Technology: Instructor's Guide.* Chicago: Portland Cement Association, 1965.

III. Film: "Broadway Two." Available from Portland Cement Association, Old Orchard Road, Skokie, Illinois 60076.

TILT-UP, PRECAST, AND LIFT SLABS
UNIT X

INFORMATION SHEET

I. Terms and definitions

   A. Precast--Concrete prepared on ground at job site or at plant, moved, and set into position

   B. Patching--Process of filling form tie holes, honeycomb, and other defects in concrete

   C. Job site--Location of construction

   D. Precast plant--Specially equipped plant where precast units can be poured in an assembly line production method

   E. Jacking process--Process of using hydraulic jacks to jack concrete floor slabs in place

   F. Not seasonal--Can be done any time, even during extremely cold periods

II. Tilt-up construction (Transparency 1)

   A. Job-site form of precast concrete construction

   B. Involves the lifting and tilting of units into place

III. Reasons for using tilt-up construction

   A. Economy

   B. Speed of construction

   C. Not seasonal

IV. Jobs done by cement masons in tilt-up construction

   A. Check forms

   B. Place concrete

   C. Finish concrete

   D. Patch panels

   E. Apply aggregate on exposed aggregate units

   F. Cure concrete

INFORMATION SHEET

V. Most critical stage of tilt-up construction--Tilting up of panels (Transparency 2)

(NOTE: This is the most critical stage because it is essential to avoid damage to panels. Care must be taken to protect the workmen.)

VI. Precast concrete--Concrete placed and finished on job site or at precast plant, cured, transported to position, and set in place (Transparency 3)

VII. Main reasons for using precast units

  A. Economy

  (NOTE: Precast slabs can be cast in an assembly line production method, stockpiled, and then set in place at a convenient time.)

  B. Speed of construction

  C. Not seasonal

  D. Minimum maintenance

  E. Beauty

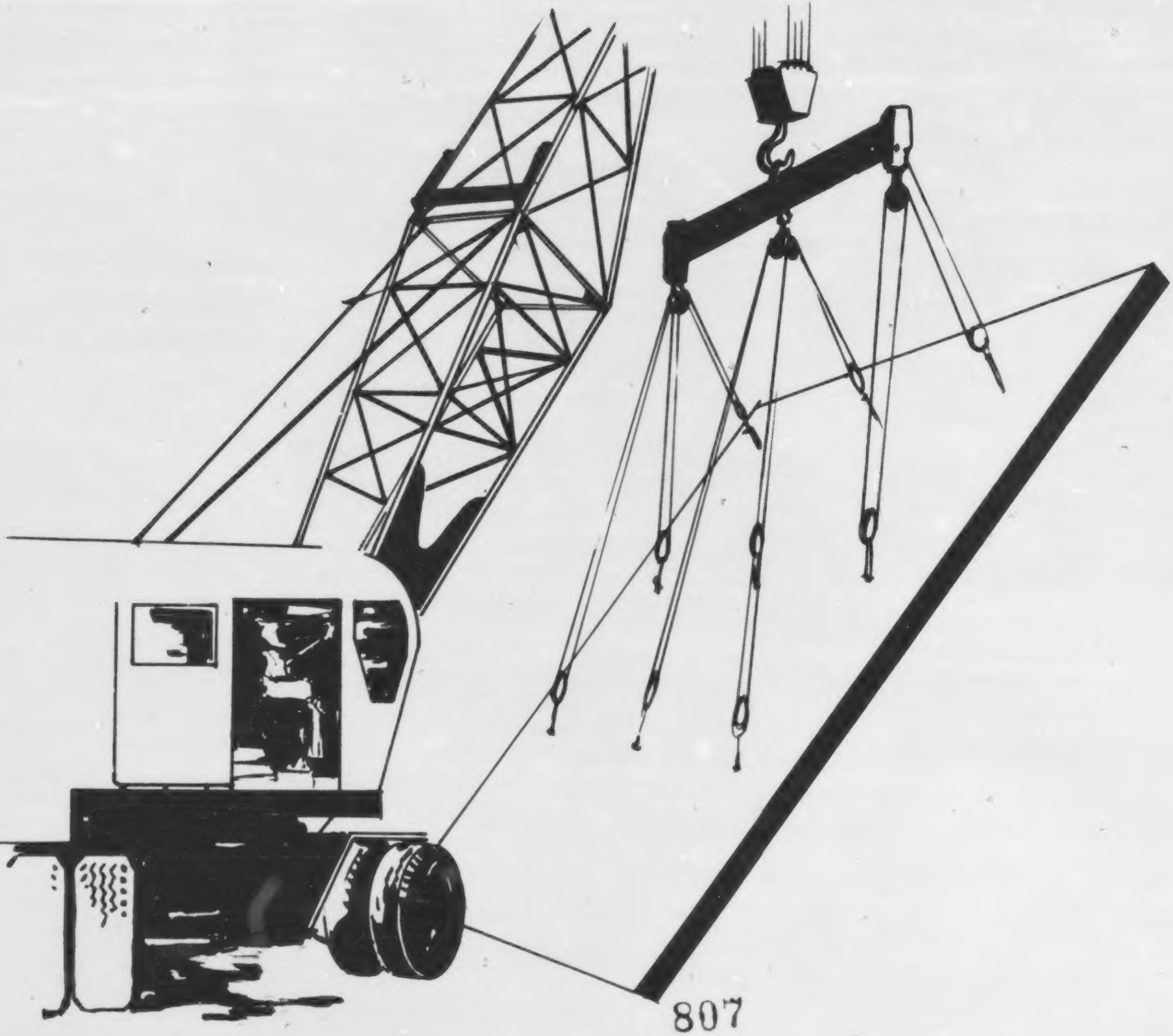
VIII. Lift slab--Process where floor slabs are cast on the ground, one on top of the other, jacked into place, and fastened to columns (Transparency 4)

IX. Advantages of using lift-slab construction

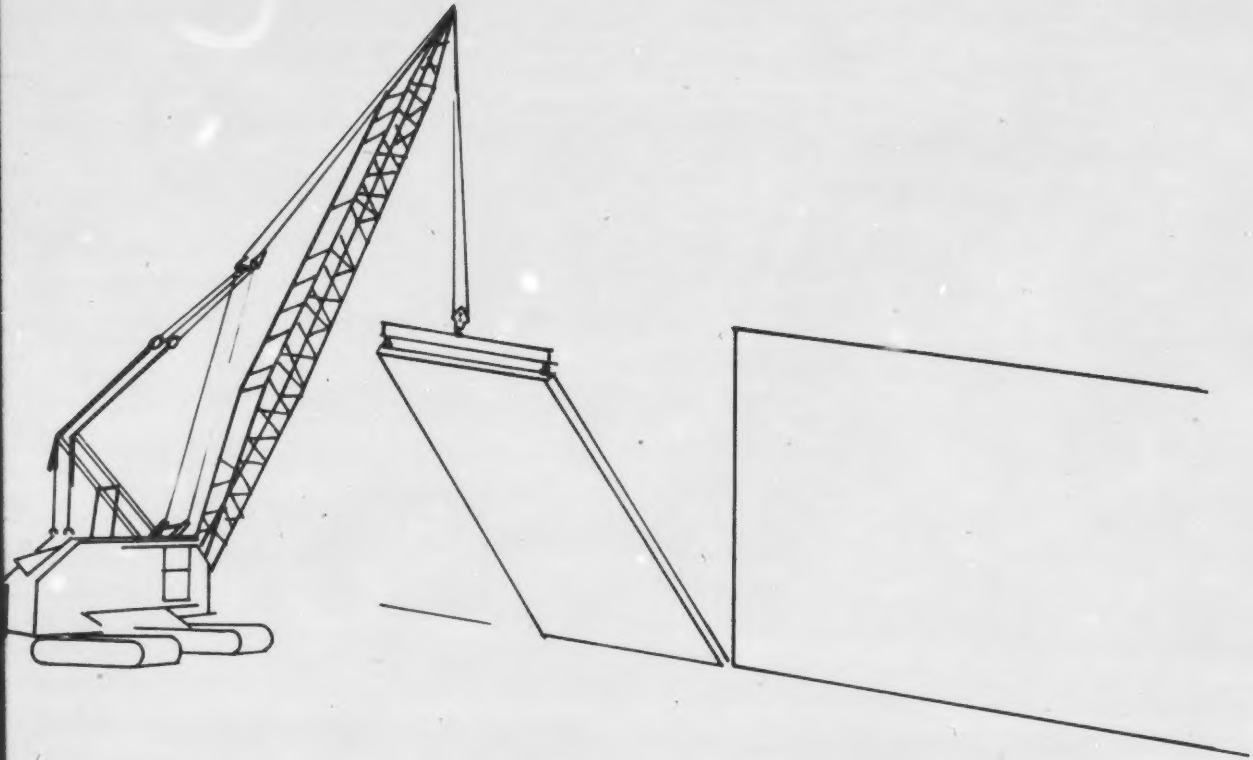
  A. Easier to pour and finish

  B. Jacking process can be done during bad weather

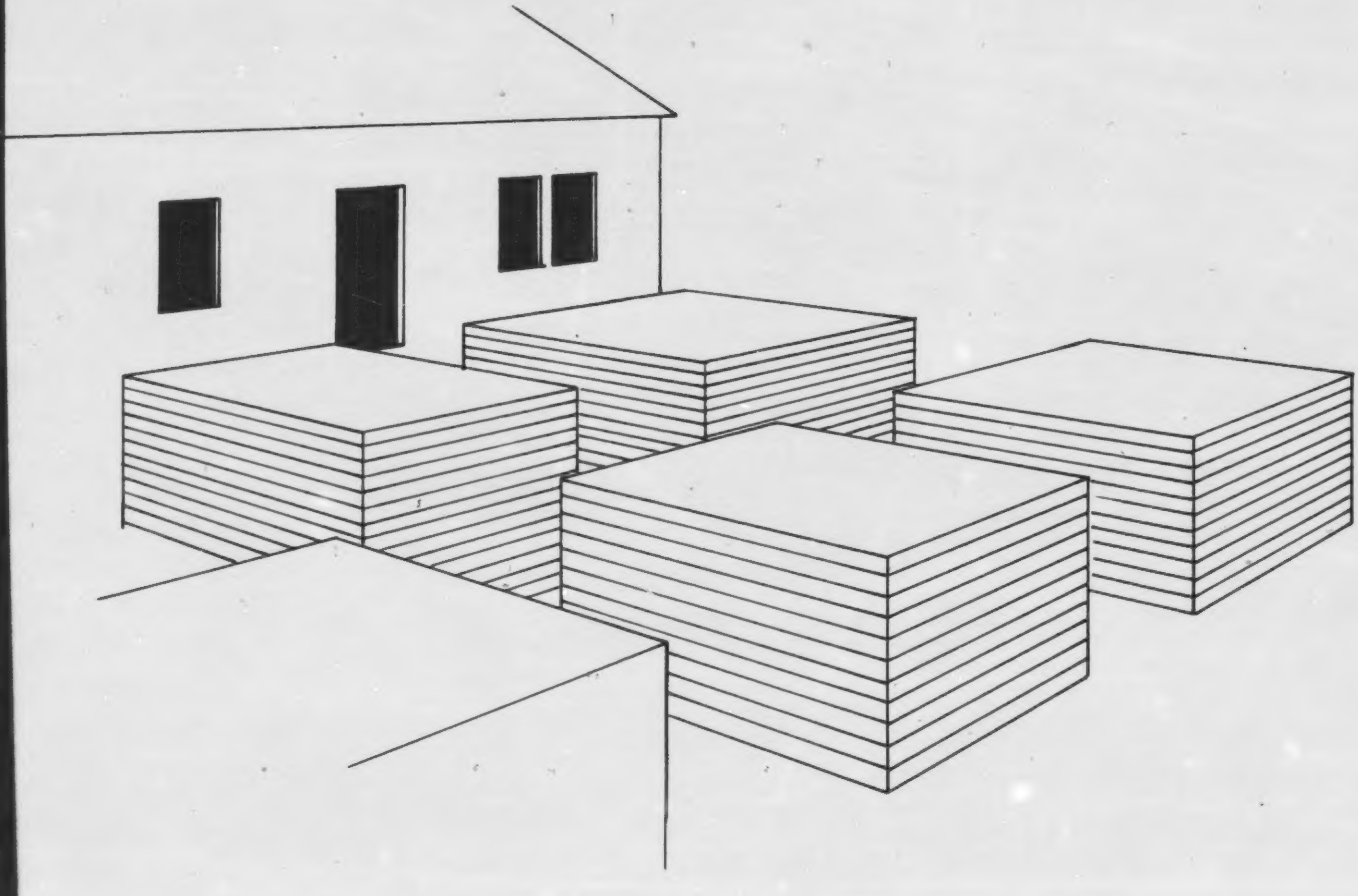
Tilt-Up Construction



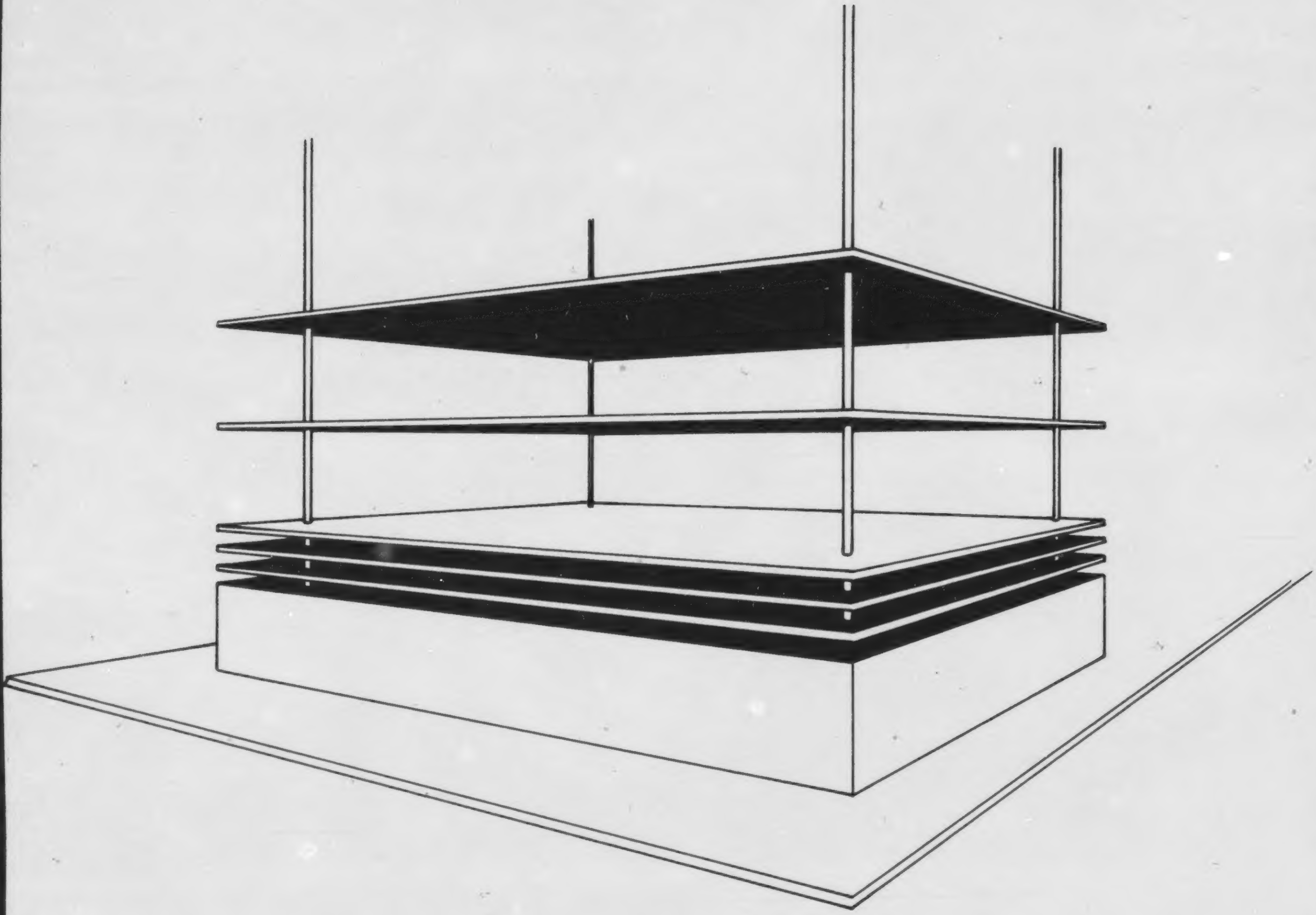
Critical Stage of Tilt-Up Construction



Precast Plant



Lift-Slab Construction



TILT-UP, PRECAST, AND LIFT SLABS
UNIT X

TEST

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

   _____a. Location of construction

   _____b. Process of using hydraulic jacks to jack concrete floor slabs in place

   _____c. Specially equipped plant where precast units can be poured in an assembly line production method

   _____d. Concrete prepared on ground at job site or at plant, moved, and set into position

   _____e. Can be done any time, even during extremely cold periods

   _____f. Process of filling form tie holes, honeycomb, and other defects in concrete

   1. Precast
   2. Patching
   3. Job site
   4. Precast plant
   5. Jacking process
   6. Not seasonal

2. Discuss tilt-up construction.

3. Name three reasons for using tilt-up construction.

   a.

   b.

   c.

4. Select from the list below jobs done by cement masons in tilt-up construction. Circle the correct letters.

   a. Order concrete

   b. Place concrete

   c. Operate concrete truck

   d. Patch panels

   e. Transport panels

   f. Check forms

   g. Finish concrete

   h. Tilt up panels

5. Select from the list below the most critical stage of tilt-up construction. Circle the correct letter.

   a. Forming

   b. Finishing panels

   c. Tilting up panels

   d. Transporting

6. Define precast concrete.

7. Name five reasons for using precast units.

   a.

   b.

   c.

   d.

   e.

8. Define lift slab.

9. Name two advantages of using lift-slab construction.

   a.

   b.

TILT-UP, PRECAST, AND LIFT SLABS
UNIT X

ANSWERS TO TEST

1. a. 3
   b. 5
   c. 4
   d. 1
   e. 6
   f. 2

2. Discussion should include the following points.

   a. Job-site form of precast concrete construction

   b. Involves the lifting and tilting of units into place

3. a. Economy

   b. Speed of construction

   c. Not seasonal

4. b, d, f, g

5. c

6. Concrete placed and finished on job site or at precast plant, cured, transported to position, and set in place

7. a. Economy

   b. Speed of construction

   c. Not seasonal

   d. Minimum maintenance

   e. Beauty

8. Process where floor slabs are cast on the ground, one on top of the other, jacked into place, and fastened to columns

9. a. Easier to pour and finish

   b. Jacking process can be done during bad weather

CEMENT MASON'S

PROGRESS CHART

Section E-1

Concrete Finishes: Building

	UNIT I Edge Forms on Grade				UNIT II Finishing Concrete Floors											UNIT III Finishing Concrete Roofs				
	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	1	2	3		
Job	UNIT TEST	Construct Edge Forms for Slab on Grade without Foundation	Construct Forms for Slab on Grade with Foundation	Construct Edge Forms for a Stoop	UNIT TEST	Finish Small Slab with Float Finish	Finish Large Slab with Float Finish	Finish Slab with Rough Broom Finish	Finish Slab with Hand Trowel	Finish Slab with Fine Broom Finish	Finish Slab Using Trowel Machine	Finish Slab with Swirl Finish: Sweat Trowel	Place and Prepare Subbase Slab for Topping	Finish Slab Using Special Type Topping: Monolithic Two Course Method	Finish Slab Using Special Type Topping: Monolithic Dry Shake Method	UNIT TEST	Place and Finish a Reinforced Cast-in-Place Umbrella Type Roof			
Student's Name																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				

	Accuracy																			
	85% Correct	Elevation ± 1/8" Square ± 1/4" Alignment ± 1/4" @ 50' Adequate Bracing	Elevation ± 1/8" Square ± 1/4" Alignment ± 1/4" @ 50' Adequate Bracing	Elevation ± 1/8" Square ± 1/4" Alignment within 1/4" Adequate Bracing	85% Correct	± 1/8" in 10'	± 1/8" in 10'	± 1/8" in 10'	± 1/8" in 10'	± 1/8" in 10'	± 1/8" in 10'	± 1/8" in 10'	Subbase Slab ± 1/4" in 10' Finish Slab Elevation ± 1/8" in 10'	Subbase Slab ± 1/4" in 10' Finish Slab Elevation ± 1/8" in 10'	± 1/8" in 10'	85% Correct	± 1/4" Slope to Drain in 10' from required slope			
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9																				
10																				
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CEMENT MASON'S
PROGRESS CHART

Section E-2
Concrete Finishes: Building

	UNIT IV Finishing Concrete Steps						UNIT V On Grade Curb Forms			UNIT VI Finishing Concrete Sidewalks and Patios										
	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	7	8	9	10	11
Job	UNIT TEST	Set Forms for Steps on Solid Fill	Set Forms for Short Set of Steps	Pour and Finish Steps with Fine Swirl Finish	Pour and Finish Pan Steps with Nonskid Finish	Pour and Finish Steps with Manufactured Nosings and Pipe Inserts	UNIT TEST	Construct a Curb and Gutter Form		UNIT TEST	Place and Finish Sidewalk with Float Finish	Place and Finish Sidewalk with Fine Swirl Finish	Place and Finish Sidewalk with Fine Broom Finish	Place and Finish Sidewalk with Exposed Aggregate Finish	Place and Finish Sidewalk with Swirl Finish Using Nonskid Material	Place and Finish Sidewalk with Rock Salt Finish	Place and Finish Sidewalk with Travertine or Keystone Finish	Place and Finish Sidewalk with Geometric Finish	Place and Finish Sidewalk with Fine Swirl Finish Using Ready-Mix Color	Place and Finish Sidewalk with Fine Broom Finish Using Color with Dry Shake Method
Student's Name																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct	Tread-Level across. Riser-Plumb. Tread-1/4" slope. Adequate bracing.	Tread-Level across. Riser-Plumb. Tread-1/4" slope. Adequate bracing.	Tread-Level across with 1/4" slope per step	Tread-Level across with 1/4" slope per step	Tread-Level across with 1/4" slope per step. Trowel tight to hosing.	85% Correct	Elevation ± 1/4" @ 50'. Plumb ± 1/8" Alignment 1/4" in 10'. Adequate bracing.		85% Correct	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required	1/4" slope per. ft. away from bldg. or as required
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CEMENT MASON'S
PROGRESS CHART

Section E-3
Concrete Finishes: Building

	UNIT VII Finishing Concrete Drives, Approaches, Curbs and Curbs and Gutters						UNIT VIII Joints in Concrete			UNIT IX Concrete Bases			UNIT X Tilt-up Precast and Lift Slabs							
Job	1	2	3	4	5	6	1	2	3	1	2	3	1	2	3					
Student's Name	UNIT TEST	Place and Finish Approach with Curbs	Place and Finish Roll Type Curb and Gutter	Place and Finish Drive with Curbs	Place and Finish Straight Curb		UNIT TEST			UNIT TEST	Run a Straight Base	Run a Cove Base	UNIT TEST							
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy	85% Correct	Elevation curbs and drives ± 1/8" in 10' Curbs-Plumb. Drain as required.	Elevation ± 1/8" in 10' Slope as required	Elevation curbs and drives ± 1/8" in 10' Curbs-Plumb. Drain as required.	Elevation ± 1/8" in 10'		85% Correct			85% Correct	1/8" Plumb with existing wall	1/8" Plumb with existing wall	85% Correct							
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9																				
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HIGHWAY
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name characteristics of the slipform and form paver and be able to discuss the operation of a tube float machine. He should be able to demonstrate the ability to check, level, and finish pavement behind the paving machine. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with highway to the correct definitions.
2. Identify four types of pavers.
3. Name the characteristics of the slipform paver.
4. Name the characteristics of a form paver.
5. Match tools to the proper uses.
6. Distinguish between a one-quarter inch and a three-quarter inch edger according to use.
7. Discuss in a short paragraph the operation of the tube float machine.
8. Name characteristics of an automatic curb and gutter machine.
9. Name characteristics of a slipform curb machine.
10. Identify two types of work bridges.
11. Identify two types of automatic finishers.
12. Demonstrate the ability to check, level, and finish pavement behind paving machine.

HIGHWAY
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information and job sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Contact CMI Corporation and Portland Cement Association for films.

   G. Demonstrate and discuss procedure outlined in job sheet.

   H. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Demonstrate the ability to accomplish the procedure outlined in the job sheet.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Tools

      2. TM 2--Tools (Continued)

      3. TM 3--Work Bridges

- D. Job Sheet #1--Check, Level, and Finish Pavement Behind Paving Machine
- E. Test
- F. Answers to test

II. References:

- A. *Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1974.
- B. Power Curbers, Inc. *News from the Gutter.* Fall, 1971, Vol. 9, No. 1.
- C. *GOMACO C-450: The Proven Concrete Finisher.* Ida Grove, Iowa: GOMACO Coprporation.
- D. CMI Corporation, P.O. Box 1985, Oklahoma City, Oklahoma 73101.

III. Films:

- A. CMI Corporation, P.O. Box 1985, Oklahoma City, Oklahoma 73101.
    1. "Houston Story"
    2. "The Roadbuilders"
    3. "Sargent"
    4. "Slipform Paving"
    5. "The Suburban Paver"
- B. Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60076.
    1. "Slipforming a Runway in 40 Days"
    2. "Iowa Special"
    3. "Airports Discover Slipform"

HIGHWAY
UNIT I

INFORMATION SHEET

I. Terms and definitions

   A. Birdbath--Low spot in pavement

   B. Honeycomb--Cavity or pit in concrete

   C. Mud--Mixture of sand, cement, and water

      (NOTE: Gravel is added to fill low places in highway.)

   D. Fish eyes--Opening in the surface of concrete, usually caused by gravel

   E. Bump--High spot on surface of concrete that was not properly rodded

   F. Header board--Board used to contain concrete at end of pour

      (NOTE: Header board is another term for bulkhead.)

   G. Pit--Area in front of strike-off board on small pours or in front of screed on paving machine pours

   H. Strike-off--Another term for rodding

   I. Longitudinal belt finisher--Wide belt with handles on each end used in a sawlike motion to finish surface of pavement

   J. Puddler--Worker who helps place concrete

   K. Paving--Placing and finishing concrete on highways, parking lots, and air strips

   L. Form--Wood or metal mold used to contain concrete and to serve as guideline for paving machines

   M. Ramp--Lane of concrete used to enter or leave main highway or to approach another highway

   N. Rodding--Process of dragging off concrete to a specific grade

   O. Bulkhead--Form set to cut off pour and to contain the concrete

   P. Tube float--Machine used to level and finish the surface of concrete pavement

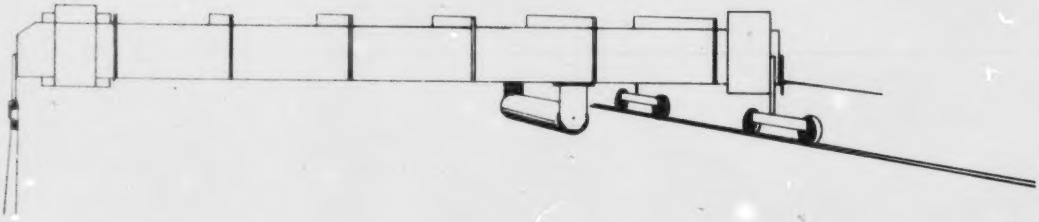
   Q. Walking edger--Edger used on pavement and large slabs by a cement mason moving in an upright position

   R. Work bridge--Type of portable bridge spanning pavement; used by workmen when finishing concrete

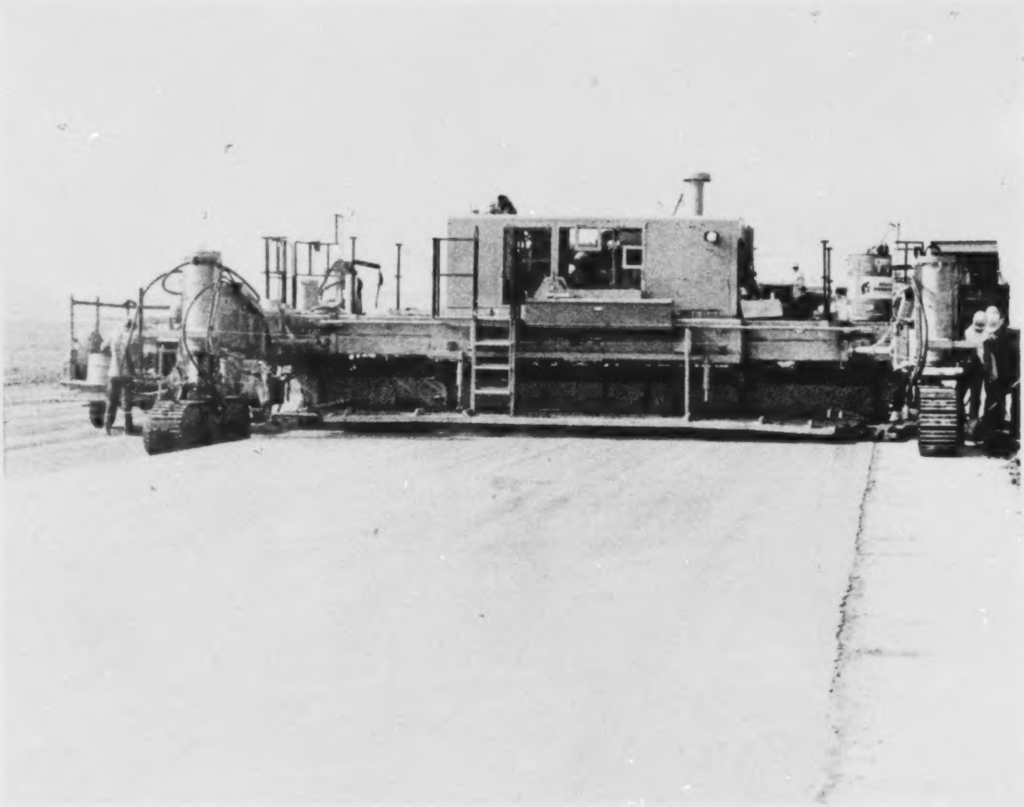
INFORMATION SHEET

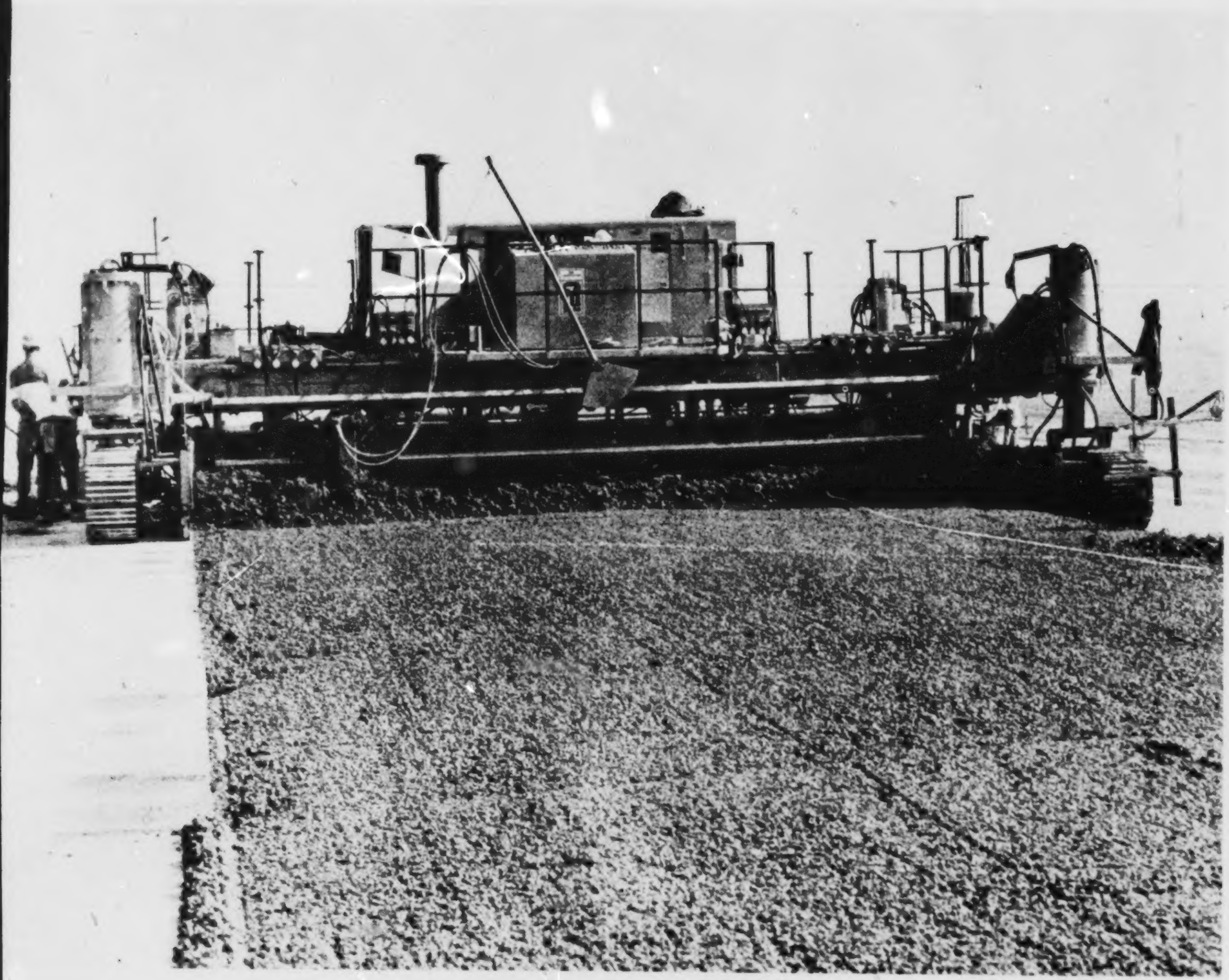
II. Types of pavers

A. Form paver



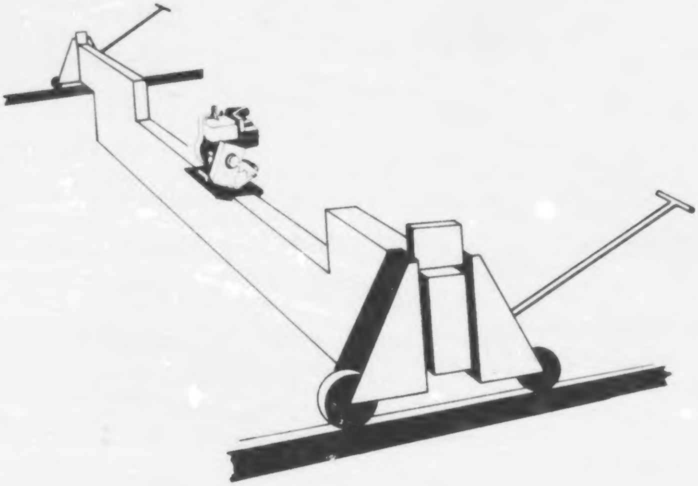
B. Slipform pavers



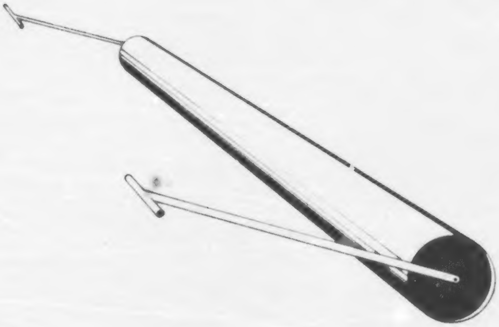


INFORMATION SHEET

C. Vibrating pull type



D. Roller type



INFORMATION SHEET

III. Characteristics of slipform paver

- A. Follows preset string line
- B. Pulls edge forms behind it
- C. Levels concrete by means of a strike-off screed
- D. Smooths surface of pavement and leaves it ready for final finish

IV. Characteristics of a form paver

- A. Travels on preset forms
- B. Levels concrete by means of two strike-off screeds
- C. Smooths pavement and leaves it ready for final finish

V. Types of tools and their uses (Transparencies 1 and 2)

- A. Paver's straightedge--Used for leveling and/or checking surface of concrete on pavement
- B. Bullfloat (wood or magnesium)--Used to level concrete to a smooth surface
- C. Edger (curb, sidewalk, or walking)--Used to form a radius at edge and/or joints in concrete
- D. Hand float (wood or magnesium)--Used to level and close up surface of concrete on sections of pavement where machines are not used
- E. Magnesium straightedge--Used to rod concrete on walks, gutters, and other sections of concrete when machines cannot be used
- F. Trowel (pointing or margin)--Used to mix mud, clean tools, and open the surface of concrete along edge of forms before using edger

VI. Uses of one-quarter inch edger and three-quarter inch edger

- A. One-quarter inch edger

  (NOTE: This edger has a one-quarter inch radius.)

  1. Pavement joint
  2. Sidewalk
  3. Back edge of curb
  4. Small section of concrete

INFORMATION SHEET

B. Three-quarter inch edger

(NOTE: This edger has a three-quarter inch radius.)

1. Outside edge of pavement
2. Curb
3. Approach
4. Large section of concrete

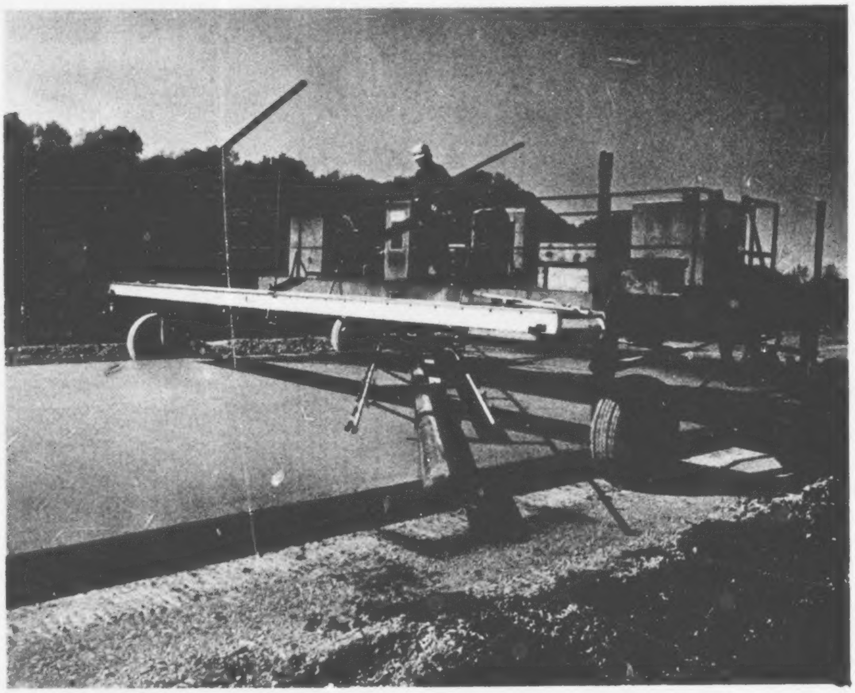
VII. Operation of tube float machine

A. Steers automatically off a preset line

B. Levels surface of pavement

C. Finishes surface of pavement

D. Seals surface



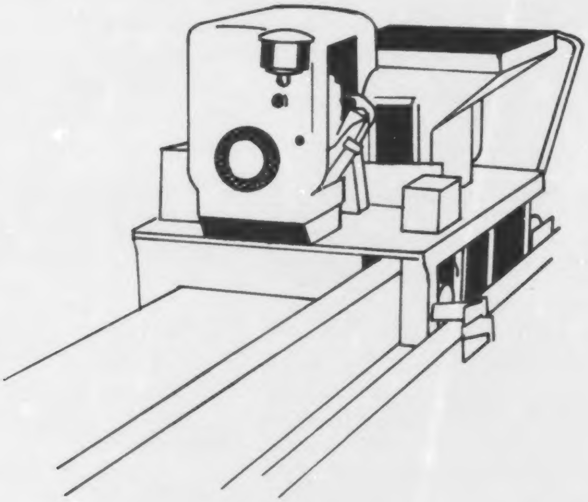
INFORMATION SHEET

VIII. Characteristics of automatic curb and gutter machine

A. Travels on preset angle-iron track

B. Produces a high density curb and gutter without forms

C. Finishes surface of curb and gutter

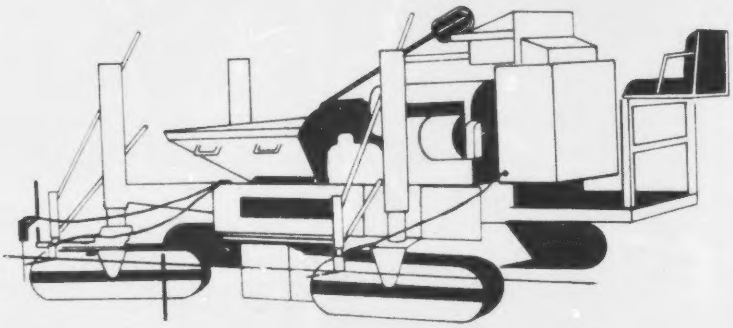


IX. Characteristics of a slipform curb machine

A. Follows a preset string line

B. Shapes and forms curb and gutter automatically

C. Leaves surface smooth and ready for final finishing



INFORMATION SHEET

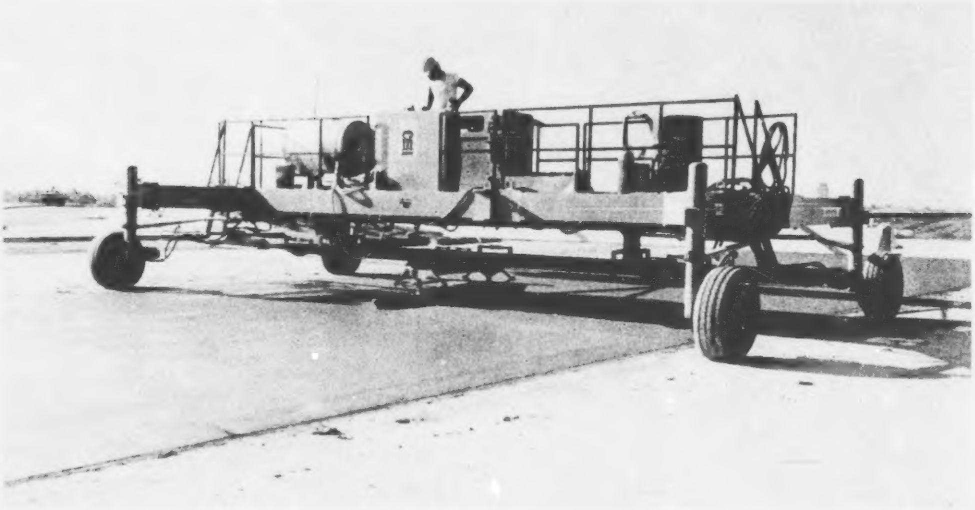
X. Types of work bridges (Transparency 3)

   A. Standard

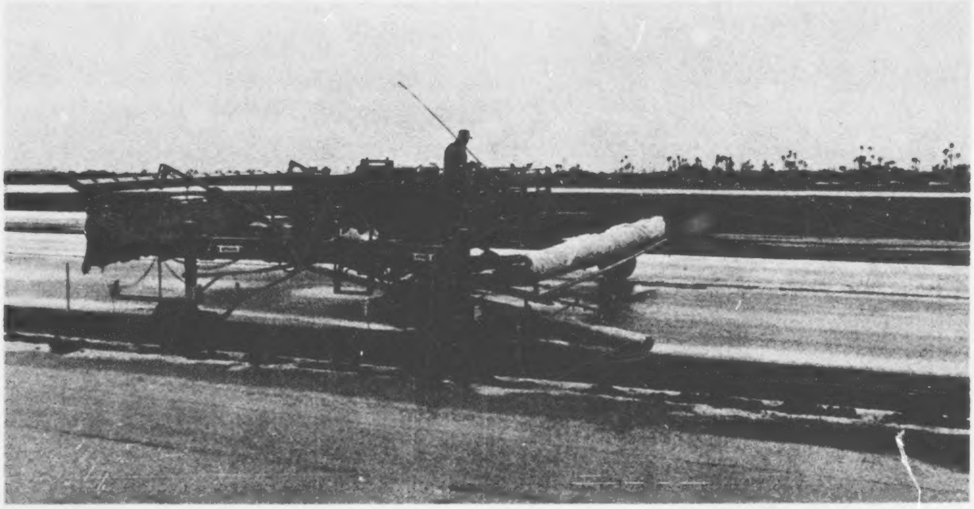
   B. Telescoping

XI. Types of automatic finishers

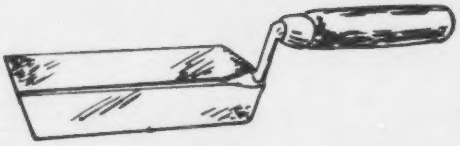
   A. Broom



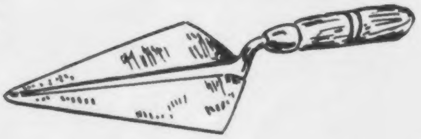
   B. Burlap



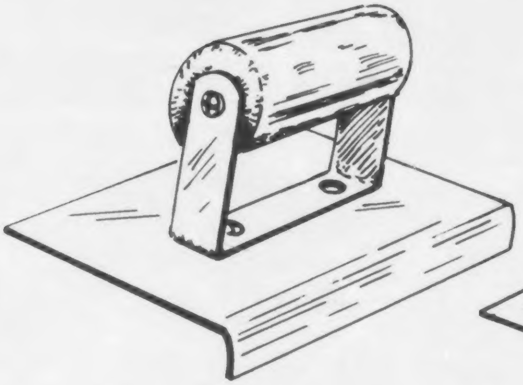
Tools



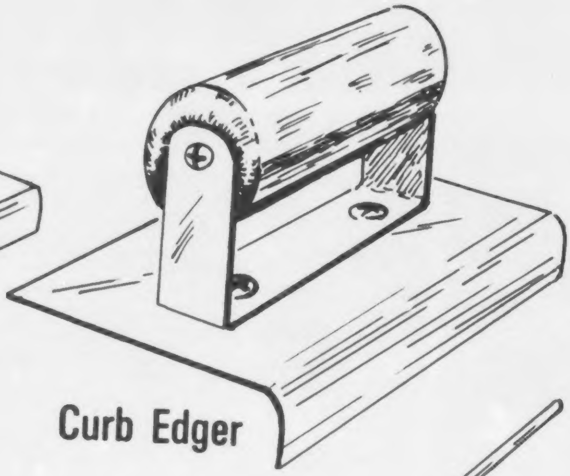
Margin Trowel



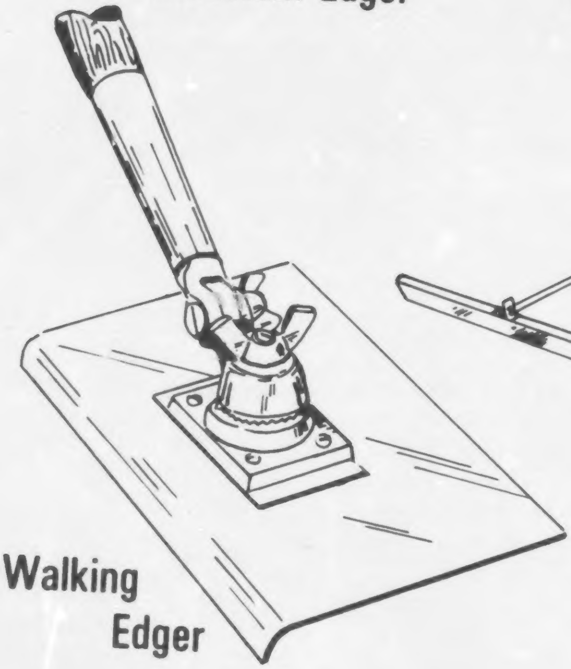
Pointing Trowel



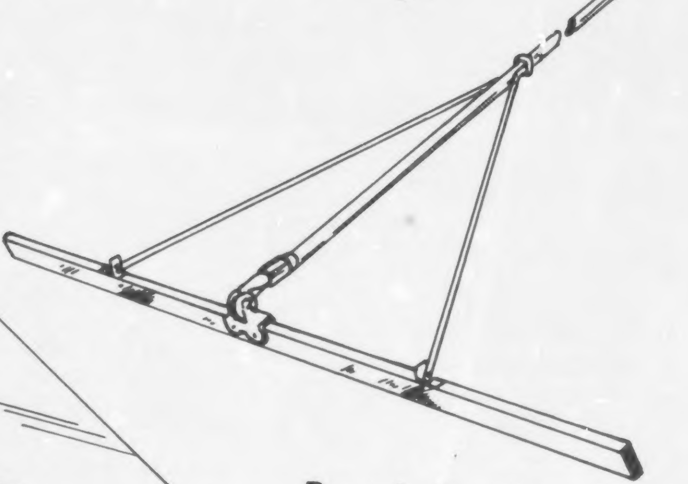
Sidewalk Edger



Curb Edger

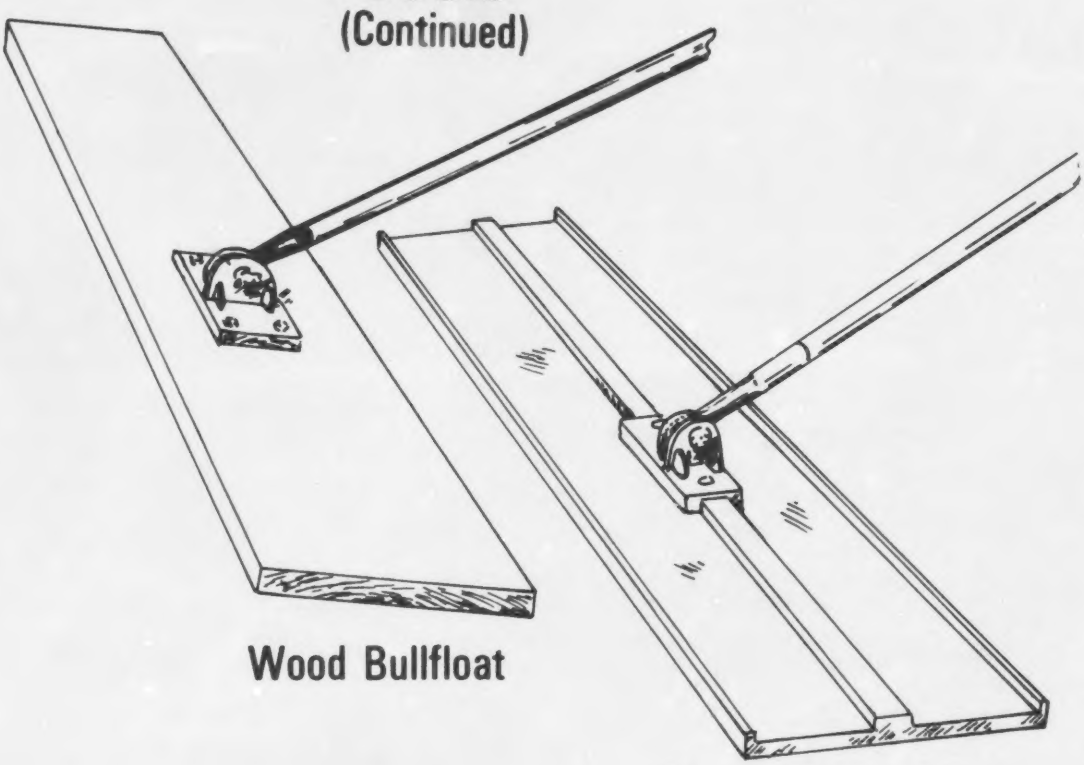


Walking Edger



Paver's Straightedge

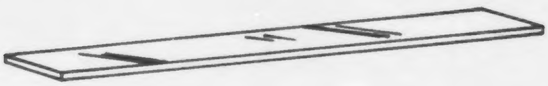
Tools
(Continued)

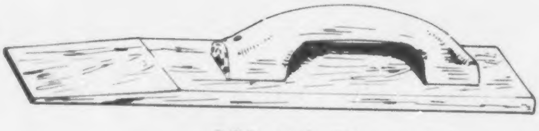


Wood Bullfloat

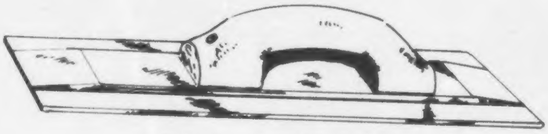
Magnesium Bullfloat

Magnesium Straightedge



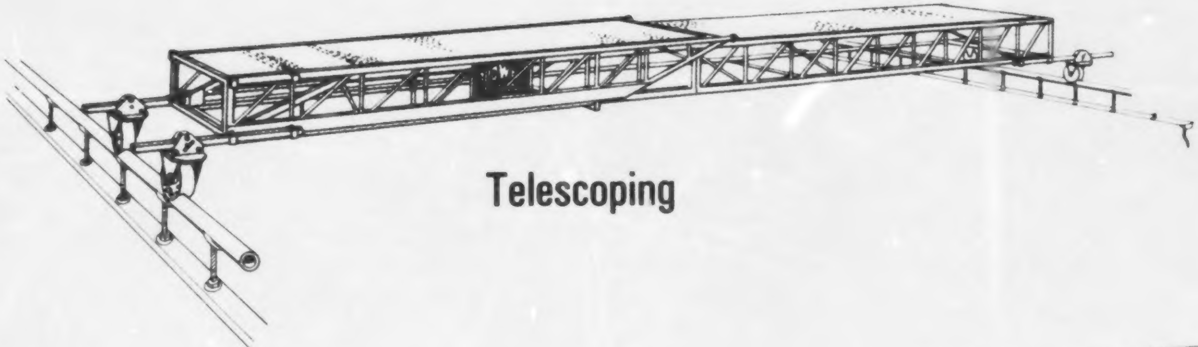


Wood Float

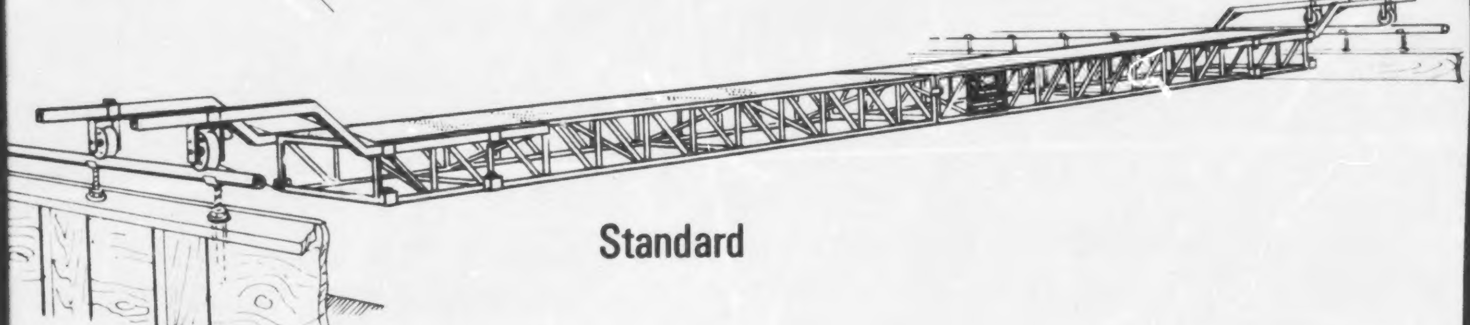


Magnesium Float

Work Bridges



Telescoping



Standard

HIGHWAY
UNIT I

JOB SHEET #1--CHECK, LEVEL, AND FINISH PAVEMENT BEHIND PAVING MACHINE

I. Tools and materials

A. Tools

1. Paver's straightedge with 14 foot handle

   (NOTE: All paving straightedges have two braces and are ten feet long and usually one inch by two inches.)

2. Bullfloat
3. Hand float
4. One-quarter inch edger
5. Three-quarter inch edger
6. Pointing trowel or margin trowel
7. Shovel
8. Sprayer

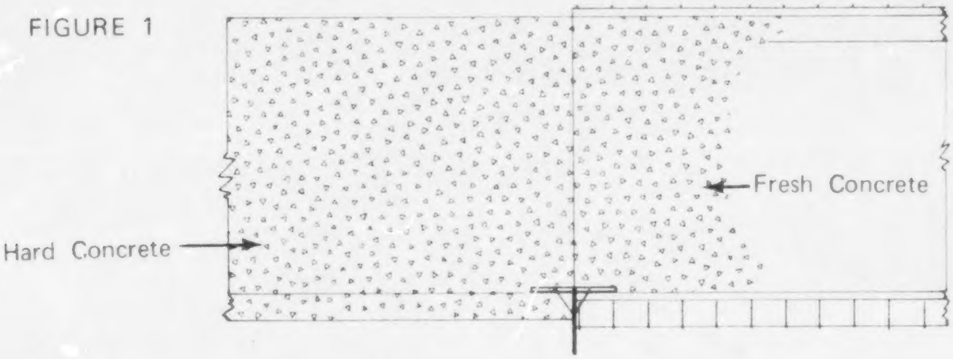
B. Materials

1. Concrete
2. Mud
3. Water
4. Curing agent

II. Procedure

A. Start at header and place half of straightedge on fresh concrete and other half across header or hard concrete (Figure 1)

FIGURE 1

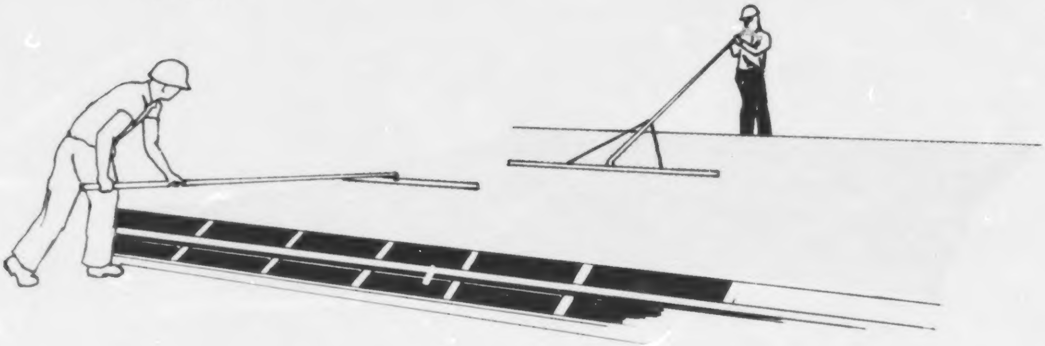


JOB SHEET #1

B. Tilt handle down and slowly push straightedge across pavement a little past center line

(NOTE: Another finisher will be doing same job on opposite side of pavement. Therefore, one finisher must start first and advance ahead of other finisher. After first pass, if straightedge rides flat across slab and does not show high or low places, the surface is level. See Figure 2.)

FIGURE 2



C. Check for low places

D. Use a shovel to place mud in low areas

(NOTE: Place a small amount of mud first so that it may be worked in with ease. If necessary, add more mud.)

E. Push straightedge across slab; then bring it back, cutting off bumps and dragging the excess mud off the edge of pavement

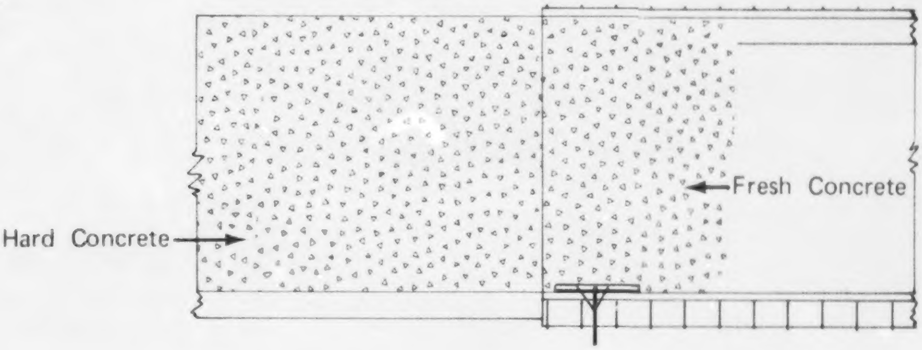
(NOTE: Bumps will be detected by the way the straightedge tears the surface.)

F. Be sure first five feet are level

JOB SHEET #1

G. Move straightedge forward (towards pour) until full length of straightedge is lying on the fresh concrete (Figure 3)

FIGURE 3



H. Continue this procedure until entire pavement has been checked and leveled

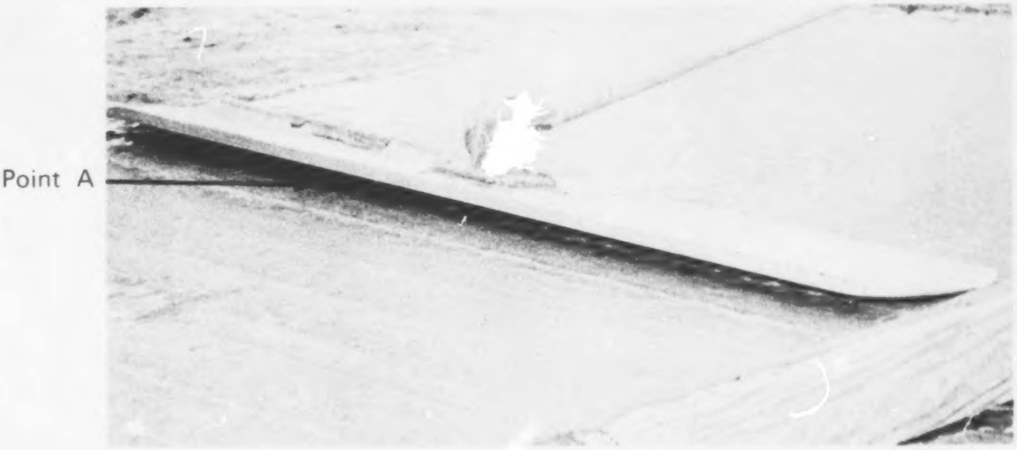
I. Finish last pass the same as first pass with half of straightedge on fresh concrete and other half across header or hard concrete

(NOTE: Be sure that with each pass you move forward only five feet or half the length of the straightedge.)

J. Complete straightedging

K. Follow up with bullfloat by positioning handle so that point A of bullfloat is slightly tilted up (Figure 4)

FIGURE 4



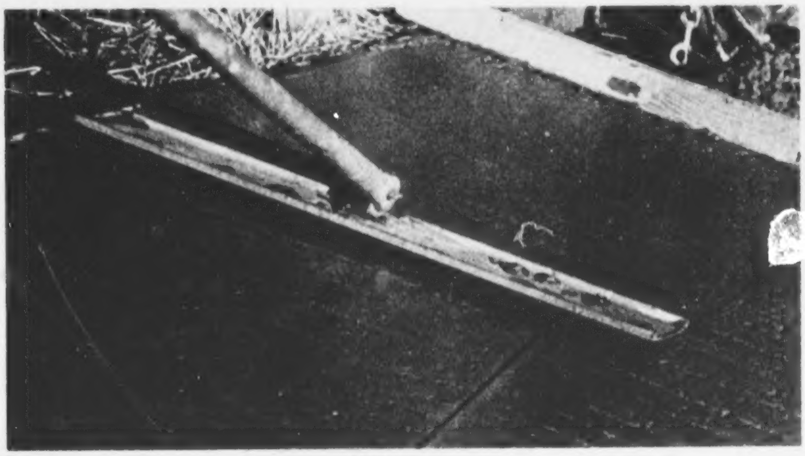
JOB SHEET #1

L. Push bullfloat halfway across slab

M. Position handle so that point B of bullfloat is slightly tilted up

N. Pull bullfloat back across slab (Figure 5)

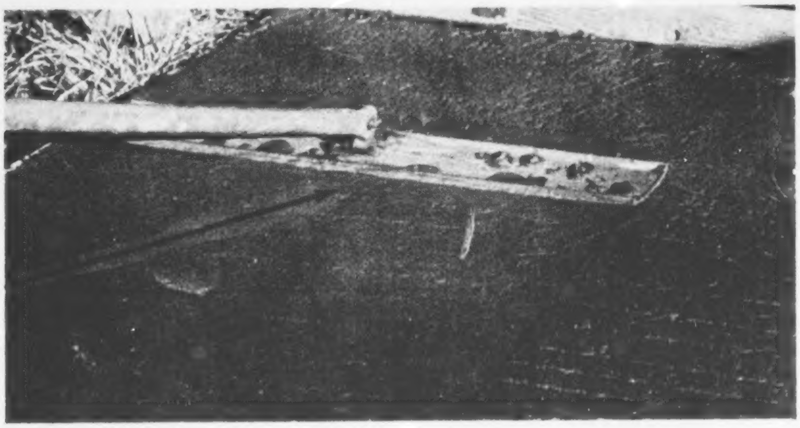
FIGURE 5



Point B

(NOTE: To check for levelness, position float so that blade is flat to surface of pavement. See Figure 6.)

FIGURE 6



Point B

JOB SHEET #1

O. Check for high places

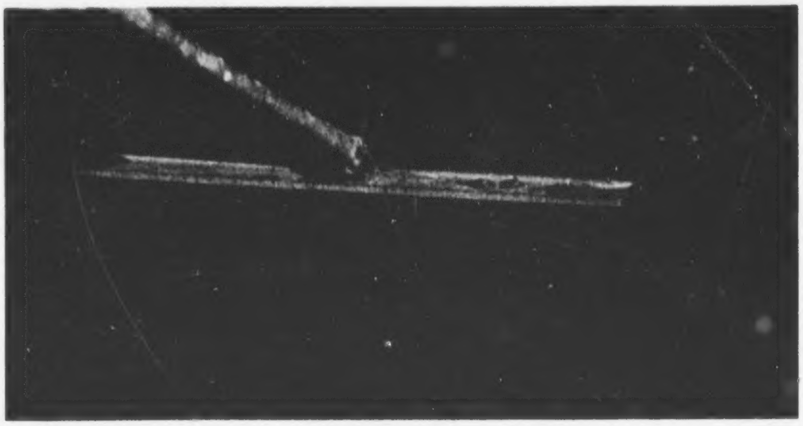
P. Position handle so that blade is relatively flat to surface and with several quick movements pull bullfloat backwards, cutting off bump

Q. Check for low places

R. Place small amount of mud in low area and work it in with a quick back and forth movement of bullfloat, continuing until low place has been leveled

(NOTE: With each pass of the bullfloat, slightly overlap preceding pass. See Figure 7.)

FIGURE 7



S. Continue this procedure until pavement has been completely floated

T. Be sure concrete is hard enough and is level with top of forms

U. Proceed to run edger

(NOTE: Quite often walking type edgers are used on pavement.)

V. Push blade of pointing or margin trowel into concrete along edge of form

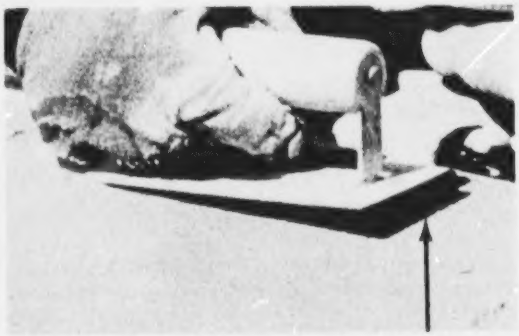
W. Draw it lengthwise along form

(NOTE: This will open up the surface next to the form.)

JOB SHEET #1

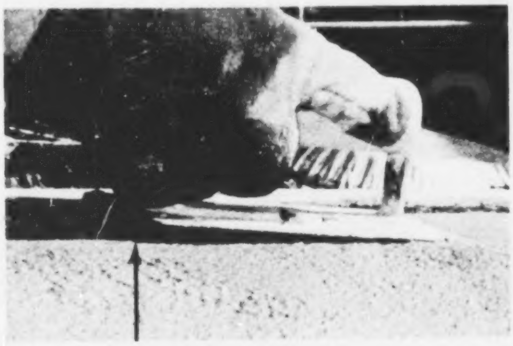
X. Place edger in position along form and slightly tilt up front edge at point A; at same time push down on handle and push forward (Figure 8)

FIGURE 8



Y. At end of stroke, slightly tilt edger at point B and pull backwards (Figure 9)

FIGURE 9



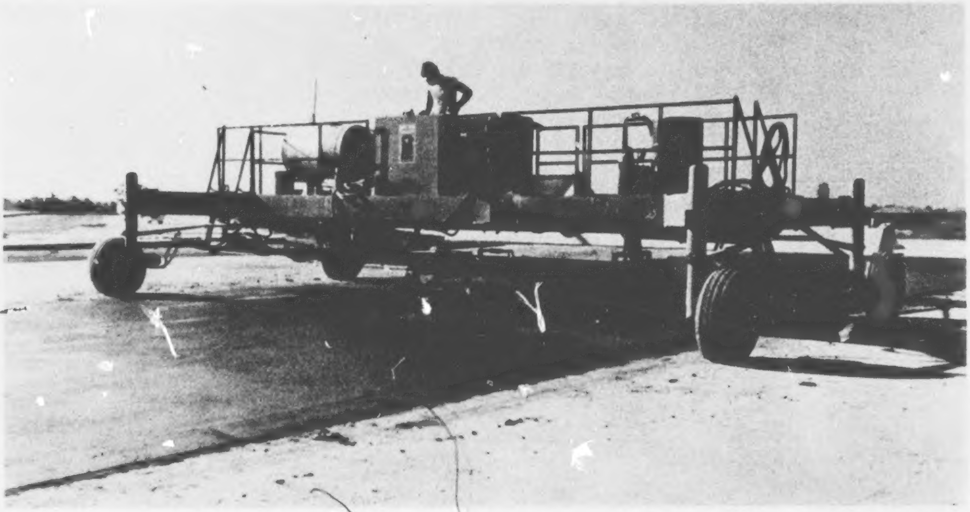
JOB SHEET #1

Z. Continue this forward and backward movement until entire pavement has been edged

(CAUTION: When running edger, be sure to hold edger level with surface of concrete. Do not edge concrete too wet. This will create high and low places.)

AA. Finish pavement with a brooming machine (Figure 10)

FIGURE 10



BB. Rerun all edges and expansions after pavement has been broomed

CC. Apply curing agent as soon after finishing as possible without damaging surface

DD. Use margin trowel, brush, and water to clean tools and equipment

HIGHWAY
UNIT I

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. (Definitions are continued on next page.)

______a. Edger used on pavement and large slabs by a cement mason moving in an upright position

______b. Wood or metal mold used to contain concrete and to serve as guideline for paving machine

______c. Lane of concrete used to enter or leave main highway or to approach another highway

______d. Board used to contain concrete at end of pour

______e. Process of dragging off concrete to a specific grade

______f. Low spot in pavement

______g. Machine used to level and finish the surface of concrete pavement

______h. Area in front of strike-off board on small pours or in front of screed on paving machine pours

______i. Opening in the surface of concrete, usually caused by gravel

______j. Form set to cut off pour and to contain the concrete

______k. Another term for rodding

______l. Worker who helps place the concrete

______m. Cavity or pit in concrete

______n. Placing and finishing concrete on highways, parking lots, and air strips

1. Birdbath
2. Honeycomb
3. Mud
4. Fish eyes
5. Bump
6. Header board
7. Pit
8. Strike-off
9. Puddler
10. Paving
11. Form
12. Ramp
13. Longitudinal belt finisher
14. Rodding
15. Bulkhead
16. Tube float
17. Walking edger
18. Work bridge

_____o. Wide belt with handles on each end used in a sawlike motion to finish surface of pavement

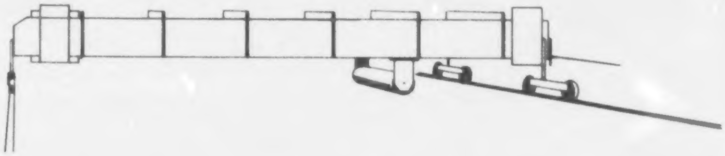
_____p. Mixture of sand, cement, and water

_____q. High spot on surface of concrete that was not properly rodded

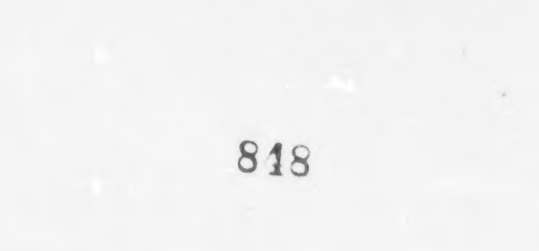
_____r. Type of portable bridge spanning pavement; used by workmen when finishing concrete

2. Identify the four types of pavers shown below. Place the correct names in the blanks provided.

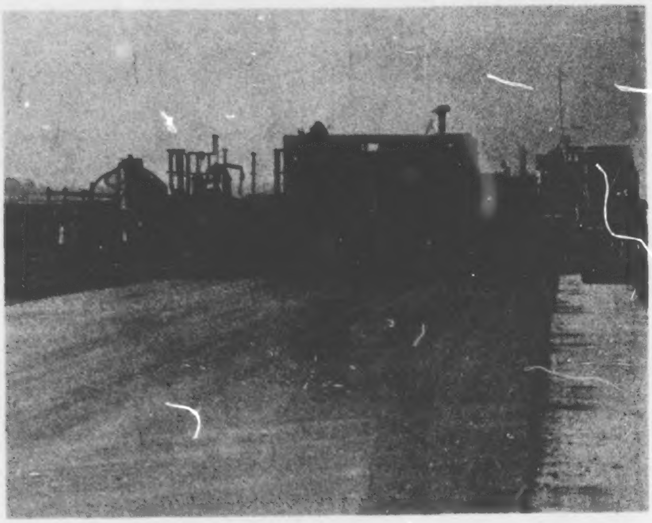
a.________________________________

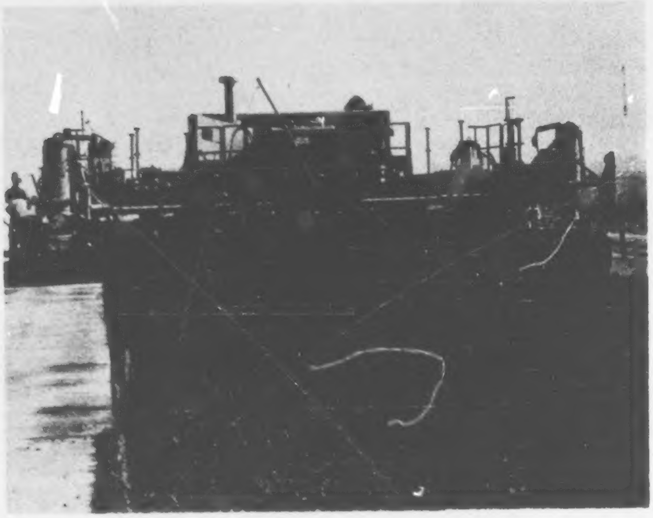


b.________________________________

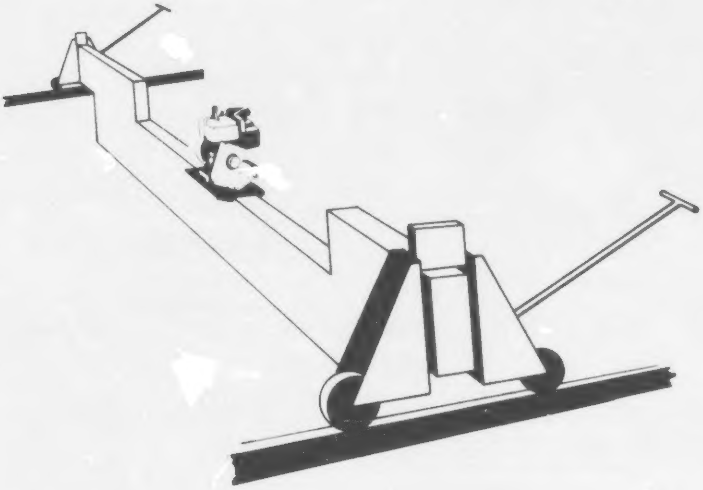


c.____





d.____



3. Name four characteristics of the slipform paver.

   a.

   b.

   c.

   d.

4. Name three characteristics of a form paver.

   a.

   b.

   c.

5. Match the tools illustrated below and on the following page to the proper uses. Place numbers of the tools in the appropriate blanks.

   ______a. Used to level and close up surface of concrete on sections of pavement where machines are not used

   ______b. Used to level concrete to a smooth surface

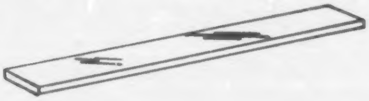
   ______c. Used to mix mud, clean tools, and open surface of concrete along edge of forms before using edger

   ______d. Used for leveling and/or checking surface of concrete on pavement

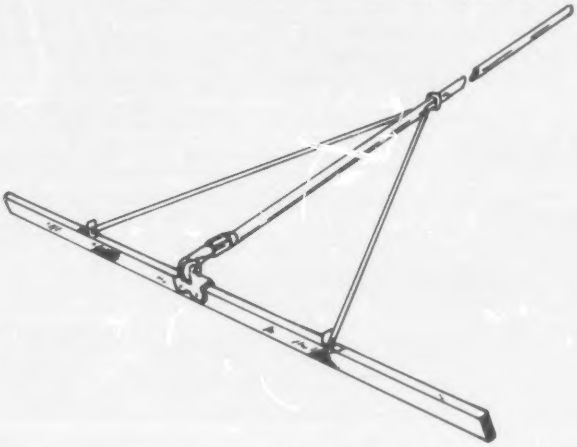
   ______e. Used to rod concrete on walks, gutters, and other sections of concrete when machines cannot be used

   ______f. Used to form a radius at edge and/or joints in concrete

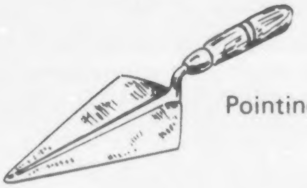
1. Magnesium Straightedge



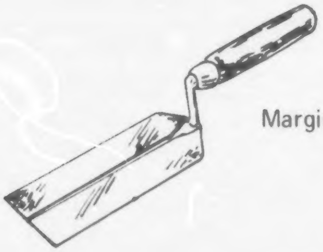
2. Paver's Straightedge



3. Trowels

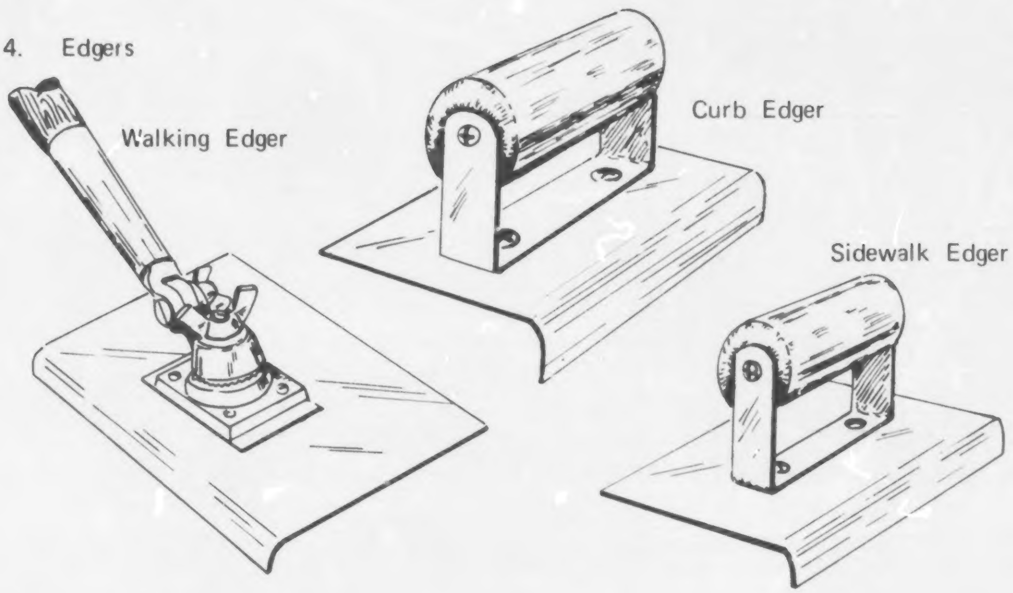


Pointing Trowel



Margin Trowel

4. Edgers

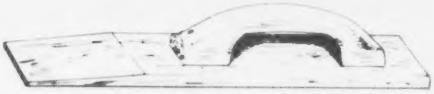


Walking Edger

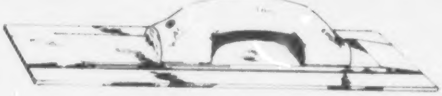
Curb Edger

Sidewalk Edger

5. Hand Floats

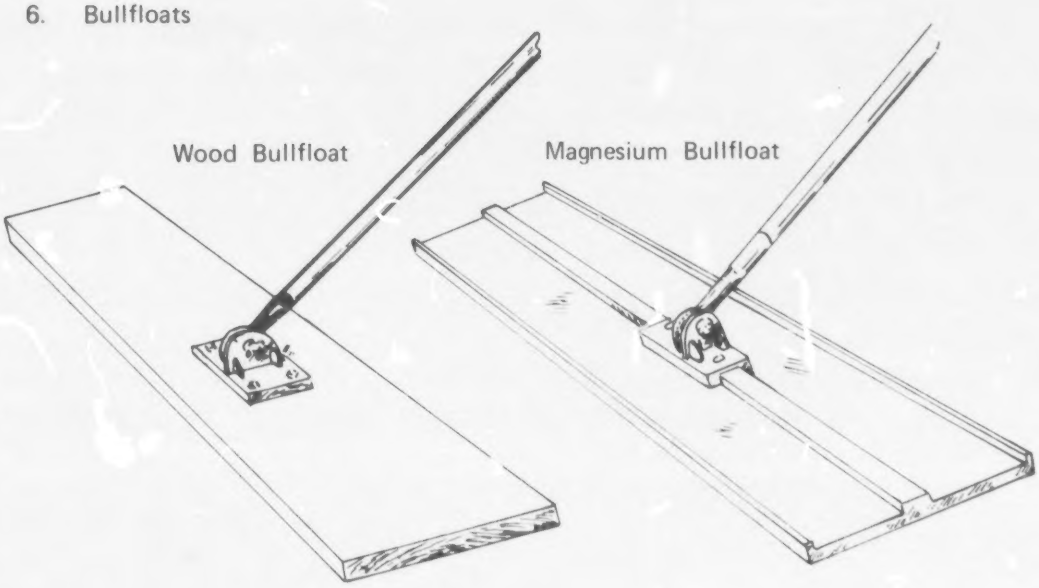


Wood Float



Magnesium Float

6. Bullfloats



Wood Bullfloat

Magnesium Bullfloat

6. Distinguish between a one-quarter inch and a three-quarter inch edger according to use. Place an "X" in the blanks that pertain to a one-quarter inch edger.

______a. Pavement joint

______b. Outside edge of pavement

______c. Small section of concrete

______d. Large section of concrete

______e. Approach

______f. Back edge of curb

______g. Curb

______h. Sidewalk

7. Discuss in a short paragraph the operation of the tube float machine.

8. Name three characteristics of an automatic curb and gutter machine.

a.

b.

c.

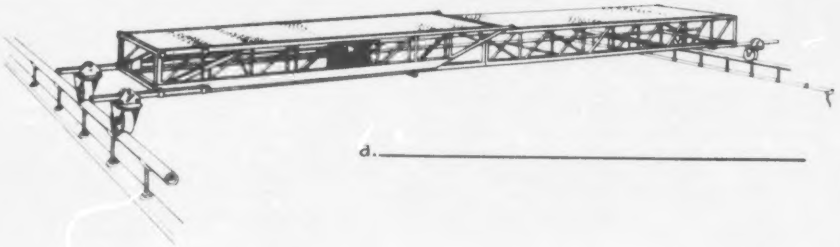
9. Name three characteristics of a slipform curb machine.

a.

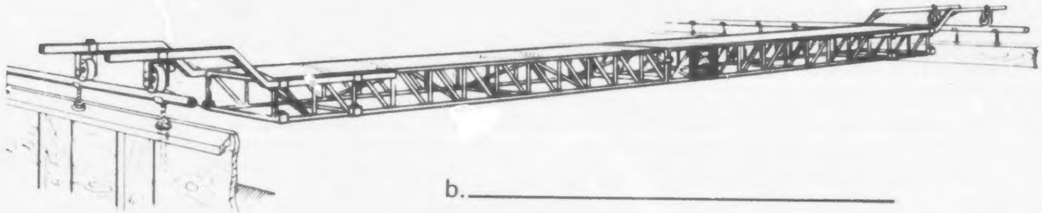
b.

c.

10. Identify the two types of work bridges.



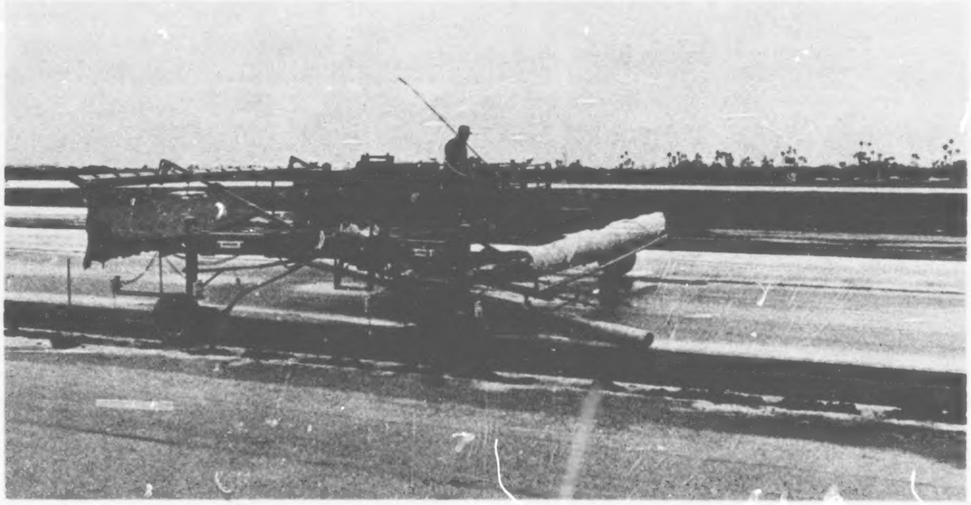
a.______________________________



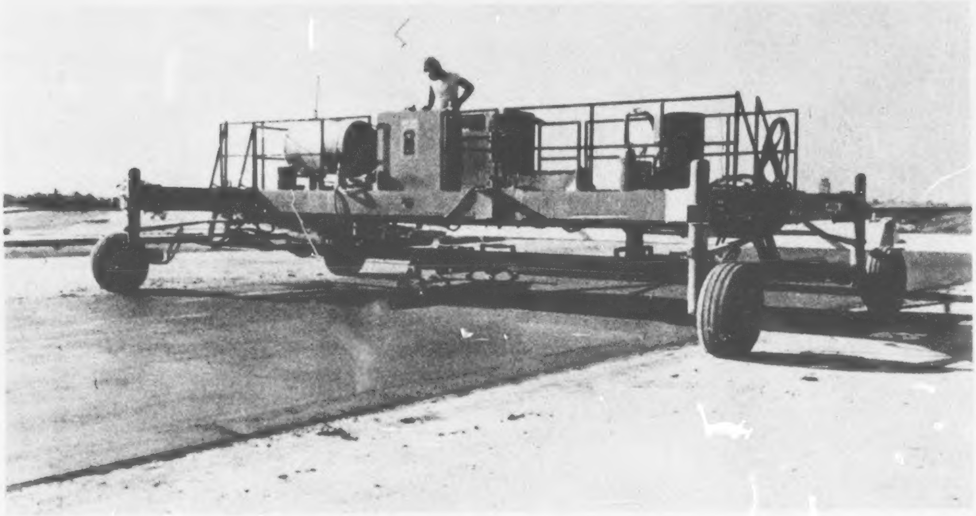
b.______________________________

11. Identify the two types of automatic finishers illustrated below and on the following page.

a.______________________________________



b.____



12. Demonstrate the ability to check, level, and finish pavement behind paving machine.

(NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

HIGHWAY
UNIT I

ANSWERS TO TEST

1. a. 17
   b. 11
   c. 12
   d. 6
   e. 14
   f. 1
   g. 16
   h. 7
   i. 4
   j. 15
   k. 8
   l. 9
   m. 2
   n. 10
   o. 13
   p. 3
   q. 5
   r. 18
2. a. Form paver
   b. Roller type
   c. Slipform pavers
   d. Vibrating pull type
3. a. Follows preset string line
   b. Pulls edge forms behind it
   c. Levels concrete by means of a strike-off screed
   d. Smooths surface of pavement and leaves it ready for final finish
4. a. Travels on preset forms
   b. Levels concrete by means of two strike-off screeds
   c. Smooths pavement and leaves it ready for final finish
5. a. 5
   b. 6
   c. 3
   d. 2
   e. 1
   f. 4
6. a, c, f, h
7. Discussion should include the following points.
   a. Steers automatically off a preset line
   b. Levels surface of pavement

- c. Finishes surface of pavement
- d. Seals surface

8. a. Travels on preset angle-iron track

- b. Produces a high density curb and gutter without forms
- c. Finishes surface of curb and gutter

9. a. Follows a preset string line

- b. Shapes and forms curb and gutter automatically
- c. Leaves surface smooth and ready for final finishing

10. a. Telescoping

- b. Standard

11. a. Burlap

- b. Broom

12. Performance skill evaluated to the satisfaction of the instructor

CEMENT MASON'S

PROGRESS CHART

Section F

Concrete Finishes: Highway

Job

	UNIT I Highway																			
	1	2	3																	
Student's Name	UNIT TEST	Check, Level, and Finish Pavement Behind Paving Machine																		
1																				
2																				
3																				
4																				
5																				
6																				
7																				

	Accuracy	85% Correct	Elevation 1/8" in 10'																	
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

CURING
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match types of curings with their method of application. He should be able to name advantages of curing and be able to discuss methods of hot and cold weather curing. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with curing to the correct definitions.
2. State four reasons for curing.
3. Match types of curing to their methods of application.
4. Discuss in a short paragraph the proper time to cure.
5. Select from a list factors that regulate curing time.
6. Select from a list variables to be considered when curing.
7. Name three advantages of curing agents.
8. Name three disadvantages of some curing agents.
9. State two methods of steam curing.
10. List two advantages of steam curing.
11. List two advantages of autoclaving.
12. Discuss in a few words precautions to take in hot weather.
13. Discuss in a few words precautions to take in cold weather.

CURING
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide each student with objective sheet.
- B. Provide each student with information sheet.
- C. Make transparencies.
- D. Discuss objectives and information sheets.
- E. Take field trip to job sites to observe types of curing.
- F. Take field trip to precast plant to observe process of steam curing.
- G. Contact Portland Cement Association for films "How to Transport, Place, Finish, and Cure Quality Concrete," "Construction of a Concrete Industrial Floor on the Ground," and "Quality Concrete Slide Reference File."
- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIAL

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency master: TM 1--Types of Curing
- D. Test
- E. Answers to test

II. References:

A. "Cold-Weather Concreting." *Concrete Information.* Chicago: Portland Cement Association, 1966.

B. "The Challenge of Winter Concreting." *Concrete Construction,* January 1966, pp. 3-5.

C. "Hot Weather Concreting." *Concrete Construction,* July 1964, p. 199.

D. "Volume Changes of Concrete." *Concrete Information.* Skokie, Illinois: Portland Cement Association, 1967.

CURING
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Curing--Process of retaining moisture within the concrete, supplying moisture to the concrete, and protecting against extreme temperature changes

B. Wet cure--To cure with water

C. Chemical cure--To cure with curing agent

D. Mechanical cure--To cure by encasing the concrete

E. Ponding--To dam edges of pour and fill with water

F. Shrinkage--Drawing up and cracking of concrete caused by rapid evaporation of water

G. Creep--Slow deformation of concrete which continues after the application of a load that is maintained on a solid material

H. Efflorescence--Deposits of soluble salts that form on surface of concrete caused by excessive mix water and calcium chloride

I. Impermeability--Resistance to passage of water through cured concrete

J. Bleeding--Water that comes to the surface after concrete is placed

K. Autoclaving--High pressure steam curing at temperatures of 325° to 375° and pressures of 80 to 170 P.S.I.

L. Spalling--Breaking off of the surface of concrete

M. Subgrade--Soil prepared and compacted to support a structure or a pavement system

N. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete

II. Reasons for curing

A. Eliminate shrinkage

B. Increase strength

C. Minimize creep

D. Improve durability

INFORMATION SHEET

E. Improve resistance to abrasion

F. Reduce efflorescence

G. Improve impermeability

III. Types of curing and their methods of application (Transparency 1)

A. Water

1. Ponding

2. Spraying

3. Soaking or sprinkling

4. Fogging

5. Covering with any absorptive material that can be kept saturated

Examples: Earth, sand, straw, burlap, and sawdust

B. Chemical

1. Liquid membrane

2. Curing agent

(NOTE: Basically, curing agents come in four colors: white pigment, light gray pigment, black, and clear. Bases vary from plastic, wax, combination wax and resin, and chlorinated rubber.)

(CAUTION: Be sure to use the curing agent specified for the particular job. Use it according to manufacturer's specifications.)

C. Mechanical

1. Waterproof paper

2. Plastic sheet

3. Spray-on membrane

D. Steam--Inject steam into a chamber or enclosure

(NOTE: Steam is maintained as to temperature and humidity.)

INFORMATION SHEET

IV. Proper time to cure

    A. When surface water has disappeared

    B. Following finishing procedures

    C. When concrete is hard enough that finish will not be damaged

V. Factors that regulate curing time

    A. Type of cement

    B. Mix proportions

    C. Required strength

    D. Size and shape

    E. Weather

    (NOTE: Follow manufacturer's specifications.)

VI. Variables to be considered when curing

    A. Time

    B. Temperature

    C. Moisture

VII. Advantages of curing agents

    A. Protection from rainfall

    B. Good moisture barrier

    C. Resistance to alkalies

    D. Resistance to oils and fuels

    E. Increase in concrete strength

VIII. Disadvantages of some curing agents

    A. Sealants will not bond

    B. Compounds with resins are not good where discoloration is objectionable

INFORMATION SHEET

C. Volatile mixtures are flammable

D. Paints and mastics do not bond

IX. Methods of steam curing

A. Low pressure

B. High pressure (autoclaving)

X. Advantages of steam curing

A. Shorter curing time

B. Improved resistance to freeze/thaw if air-entraining is used

C. High early strength

D. Earlier reuse of forms (molds)

E. Year-round operation

F. Increase in concrete strength

XI. Advantages of autoclaving

A. Reduces cracking and spalling

B. Provides high early strength

C. Reduces efflorescence

D. Lowers moisture content

E. Increases concrete strength

XII. Hot weather precautions

A. Wet down subgrade

B. Protect from wind and direct sun rays

C. Use cold water in concrete mix

(NOTE: Sometimes it is necessary to use ice in the concrete mix as a substitute for mix water.)

INFORMATION SHEET

D. Take hot weather precautions immediately after finishing in order to prevent evaporation

(NOTE: The concrete should be protected three to four days after completing the finishing work.)

XIII. Cold weather precautions

A. Insulated forms

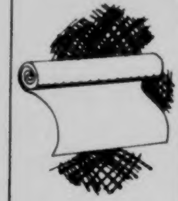
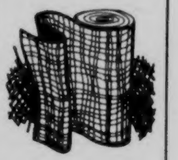
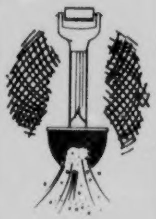
B. Protective covering

1. Tarpolins
2. Plastic
3. Straw
4. Insulated blankets

C. Enclosures

(NOTE: When using enclosures with heaters, make sure you have adequate vent openings.)

Types of Curing

Objective Sought	 Waterproof Paper	 Burlap	Chemical Membrane ("Spray")	Ponding	 Sand (2")	Sprinkling	Polyethylene Film
Moisture Retention	Good	Good but only if kept continuously wet	Fair	Good	Fair but only if kept continuously wet	Good but only if continuous	Good if film is not punctured
Protection–Frost	Good	None	None	None	Fair	None	Good
Protection–Direct Sun	Good	Good	None	Good	Good	Fair but only if continuous	Good, White Pigmented None, Black
Protection–Mortar Stain	Good	Fair	Fair to None	None	Fair	None	Good, if not torn
Protection–Traffic	Good	Fair	None	None	Good	None	Fair
Continuous Cure	Good	Good but only if kept continuously wet	Good only if uniform coverage	Good	Good but only if kept continuously wet	Good but only if continuous	Good
Visual Check	Good	Fair	None	Good	Fair	Fair	Good
Ease of Cleanup	Good	Fair	Good unless removal necessary	None	None	Fair	Good
Re-use	Good	Good	None	None	Fair	None	Fair

CURING
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

_____a. Soil prepared and compacted to support a structure or a pavement system

_____b. High pressure steam curing at temperatures of 325° to 375° and pressures of 80 to 170 P.S.I.

_____c. Resistance to passage of water through cured concrete

_____d. Slow deformation of concrete which continues after the application of a load that is maintained on a solid material

_____e. To dam edges of pour and fill with water

_____f. To cure with curing agent

_____g. Process of retaining moisture within the concrete, supplying moisture to the concrete and protecting against extreme temperature changes

_____h. Breaking off of the surface of concrete

_____i. Water that comes to the surface after concrete is placed

_____j. Deposits of soluble salts that form on the surface of concrete caused by excessive mix water and calcium chloride

_____k. Drawing up and cracking of concrete caused by rapid evaporation of water

_____l. To cure by encasing the concrete

_____m. To cure with water

_____n. Chemical compound used to prevent evaporation of moisture from concrete

1. Curing
2. Subgrade
3. Wet cure
4. Spalling
5. Autoclaving
6. Bleeding
7. Chemical cure
8. Ponding
9. Creep
10. Mechanical cure
11. Impermeability
12. Efflorescence
13. Shrinkage
14. Curing agent

2. State four reasons for curing.

   a.

   b.

   c.

   d.

3. Match the types of curing on the right to their methods of application by placing the correct number in the blanks provided.

   ______a. Fogging
   ______b. Liquid membrane
   ______c. Ponding
   ______d. Plastic sheet
   ______e. Spray-on membrane
   ______f. Soaking or sprinkling
   ______g. Waterproof paper
   ______h. Inject steam into a chamber or enclosure

   1. Mechanical
   2. Water
   3. Steam
   4. Chemical

4. Discuss in a short paragraph the proper time to cure.

5. Select from the list below factors that regulate curing time. Place an X in the blanks.

   ______a. Type of cement
   ______b. Weather
   ______c. Color
   ______d. Required strength

_____e. Slump of concrete

_____f. Mix proportions

_____g. Time and place

_____h. Size and shape

6. Select from the list below variables to be considered when curing. Place an X in the blanks.

_____a. Temperature

_____b. Time

_____c. Color of concrete

_____d. Type of job

_____e. Moisture

7. Name three advantages of curing agents.

a.

b.

c.

8. Name three disadvantages of some curing agents.

a.

b.

c.

9. State two methods of steam curing.

a.

b.

10. List two advantages of steam curing.

a.

b.

11. List two advantages of autoclaving.

a.

b.

12. Discuss in a few words precautions to take in hot weather.

13. Discuss in a few words precautions to take in cold weather.

CURING
UNIT I

ANSWERS TO TEST

1. a. 2
   b. 5
   c. 11
   d. 9
   e. 8
   f. 7
   g. 1
   h. 4
   i. 6
   j. 12
   k. 13
   l. 10
   m. 3
   n. 14

2. Any four of the following are acceptable.
   a. Eliminate shrinkage
   b. Increase strength
   c. Minimize creep
   d. Improve durability
   e. Improve resistance to abrasion
   f. Reduce efflorescence
   g. Improve impermeability

3. a. 2
   b. 4
   c. 2
   d. 1
   e. 1
   f. 2
   g. 1
   h. 3

4. Discussion should include the following points.
   a. When surface water has disappeared
   b Following finishing procedures
   c. When concrete is hard enough that finish will not be damaged

5. a, b, d, f, h

6. a, b, e

7. Any three of the following are acceptable.
   a. Protection from rainfall
   b. Good moisture barrier
   c. Resistance to alkalies
   d. Resistance to oils and fuels
   e. Increase in concrete strength

8. Any three of the following are acceptable.
   a. Sealants will not bond
   b. Compounds with resins are not good where discoloration is objectionable
   c. Volatile mixtures are flammable
   d. Paints and mastics do not bond

9. a. Low pressure
   b. High pressure (autoclaving)

10. Any two of the following are acceptable.
   a. Shorter curing time
   b. Improved resistance to freeze/thaw if air-entraining is used

- c. High early strength
- d. Earlier reuse of forms (molds)
- e. Year-round operation
- f. Increase in concrete strength

11. Any two of following are acceptable.
    - a. Reduces cracking and spalling
    - b. Provides high early strength
    - c. Reduces efflorescence
    - d. Lowers moisture content
    - e. Increases concrete strength

12. Discussion should include the following points.
    - a. Wet down subgrade
    - b. Protect from wind and direct sun rays
    - c. Use cold water in concrete mix
    - d. Take hot weather precautions immediately after finishing in order to prevent evaporation

13. Discussion should include the following points.
    - a. Insulated forms
    - b. Protective covering
        - 1) Tarpolins
        - 2) Plastic
        - 3) Straw
        - 4) Insulated blankets
    - c. Enclosures

PROTECTION
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name the three types of concrete protection. He should be able to name the reasons for protection and the methods used to protect concrete. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with protection to the proper definitions.
2. Name three types of concrete protection.
3. Select from a list reasons for protecting concrete in hot weather.
4. Name methods for protecting concrete in hot weather.
5. List reasons for protecting concrete in cold weather.
6. Name methods for protecting concrete in cold weather.
7. Select from a list precautions to take when protecting concrete during cold weather.
8. Select from a list the temperatures at which it is necessary to provide hot or cold weather protection.
9. Name types of physical protection.
10. Name reasons for using physical protection.
11. Select from a list different methods of physical protection.

PROTECTION
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information sheet.

   C. Make transparency masters.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Contact Portland Cement Association for "Quality Concrete Slide Reference File," illustrating suitable visual aids in relation to cold weather and hot weather concreting.

   G. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Hot Weather Protection

      2. TM 2--Cold Weather Protection

      3. TM 3--Cold Weather Protection (Continued)

      4. TM 4--Physical Protection

D. Test

E. Answers to test

II. References:

A. "The Challenge of Winter Concreting." *Concrete Construction,* January 1966, 3-5.

B. "Cold Weather Concreting." *Concrete Information.* Chicago: Portland Cement Association, 1966.

C. *The Specialty House.* Lance Construction Supplies, Inc., 4225 West Ogden Avenue, Chicago, Illinois.

D. Brock, Wayne. "Cold Weather Curing for Concrete." *Concrete Construction,* 19 (1974), 491-92.

PROTECTION
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Physical protection--Protection or barricade set up to protect concrete from physical damage

B. Wind shield--Panel (usually polyethylene) set up to block wind from blowing across fresh concrete

C. Sun shield--Panel (usually opaque polyethylene) set up to shield sun rays from fresh concrete

D. Enclosure--Material used to enclose area around a concrete pour, usually to keep out cold and retain heat

E. Barricade--Obstruction set up to protect concrete

F. Admixture--Component added at time of mixing and developed to mix with concrete for specific purpose

G. Subgrade--Soil prepared and compacted to support a structure or a pavement system

H. Vapor barrier--Polyethylene or other waterproof material placed on subgrade

I. Batch plant--Plant where concrete is mixed

J. Monomolecular film--Compound sprayed on fresh concrete to reduce rapid evaporation

K. Retarder--Admixture used to slow down set of concrete

L. Accelerator--Agent that speeds the set of concrete

M. Insulating blanket--Curing blanket, usually fiberglass encased in a moisture-proof cover of coated plastic or canvas

N. Salamander--Portable stove or heater usually fired by coke or fuel oil

O. Commercial barricade--Barricade with electric blinkers attached

II. Types of concrete protection

A. Hot weather protection

B. Cold weather protection

C. Physical protection

INFORMATION SHEET

III. Reasons for protecting concrete in hot weather

- A. Rapid evaporation
- B. Premature setting
- C. High temperature
- D. High winds
- E. Low relative humidity
- F. Increase in strength

IV. Methods for protecting concrete in hot weather (Transparency 1)

- A. Use a retarder in the concrete
- B. Wet down subgrade and forms
- C. Cover fresh concrete as soon as possible or apply a monomolecular film
- D. Use cold water in mix

  (NOTE: Sometimes it is necessary to use ice.)
- E. Set up wind and sun shields
- F. Spray concrete with a fine mist
- G. Use vapor barrier under slab

V. Reasons for protecting concrete in cold weather

- A. Freezing
- B. Slow set
- C. Slow strength gain

VI. Methods for protecting concrete in cold weather (Transparencies 2 and 3)

- A. Coverings

  Examples: Tarpolins, insulating and electric blankets, straw

INFORMATION SHEET

B. Enclosures

C. Heaters

(CAUTION: Make sure heaters and enclosures are well vented.)

Examples: Coke and oil salamanders, forced air oil heaters, bottled gas heaters, natural gas heaters

VII. Precautions to take when protecting concrete during cold weather

A. Do not walk on concrete when covering

B. Do not let covering drag across freshly finished concrete

C. Be sure heaters are vented

D. Do not use salamanders in a tight enclosure

E. Make sure enclosures are well braced against high winds

F. Be sure all edges of slabs are well covered

G. Be sure that when using straw it is fluffed up and that enough straw is used

VIII. Temperatures at which protection is needed

A. Below 40° Fahrenheit

B. Above 90° Fahrenheit

(NOTE: These two temperatures are specified by the architects.)

IX. Types of physical protection (Transparency 4)

A. Commercial barricade

B. Sawhorse

C. Lumber

D. Rope

X. Reasons for using physical protection

A. Vandals

B. Animals

INFORMATION SHEET

C. People

D. Vehicles

XI. Different methods of physical protection

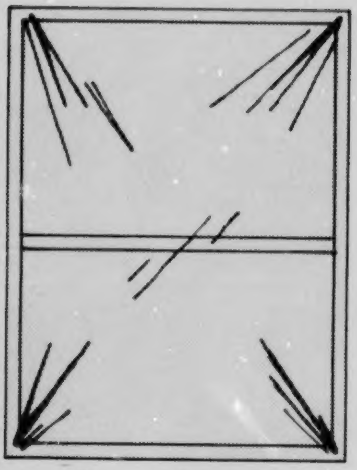
A. Set barricades and/or sawhorses at edge of pour

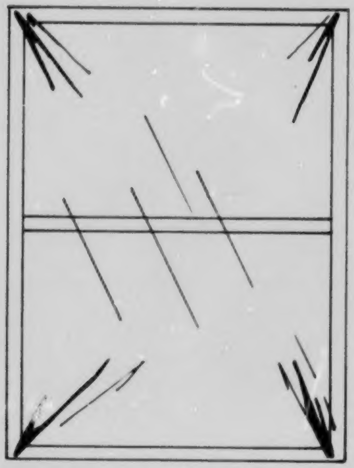
B. Stretch rope around perimeter of pour

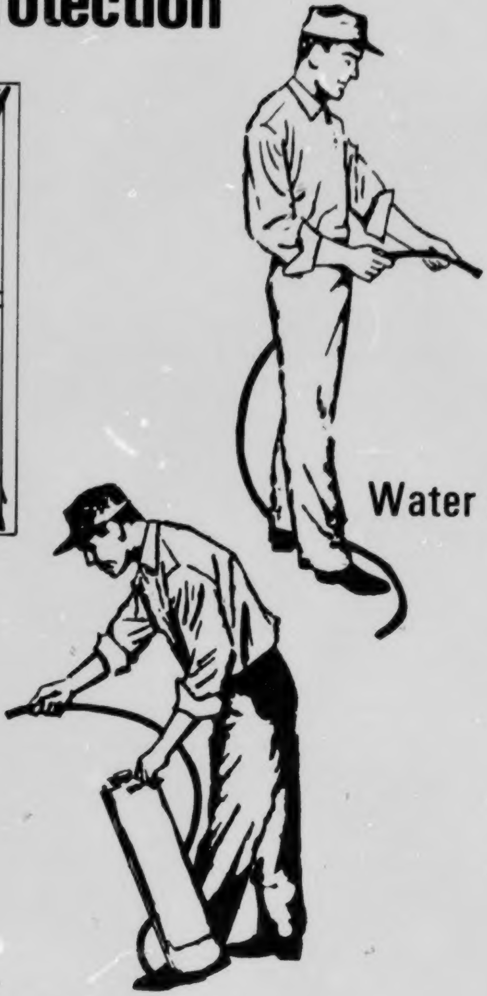
(NOTE: Attach strips of cloth every few feet.)

C. Build barricade from lumber and place around perimeter of poured area

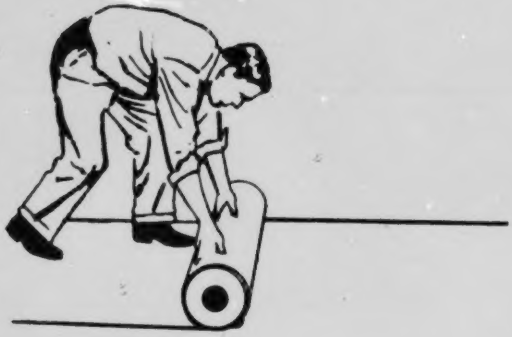
Hot Weather Protection


Sun Shield

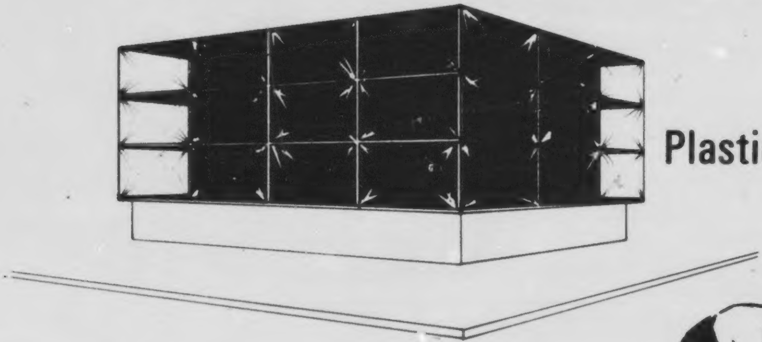

Wind Shield


Water Spray

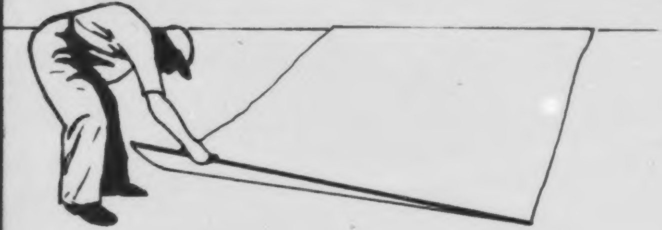
Monomolecular Film


Visqueen

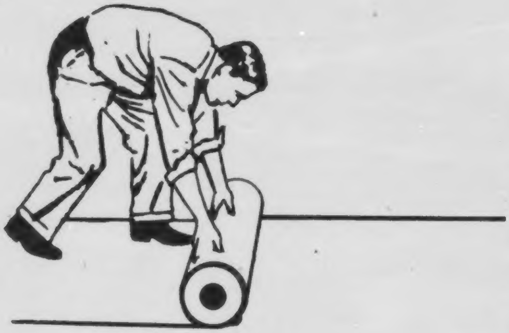
Cold Weather Protection



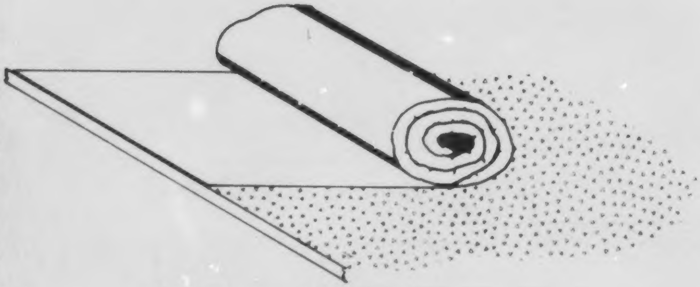
Plastic Enclosure



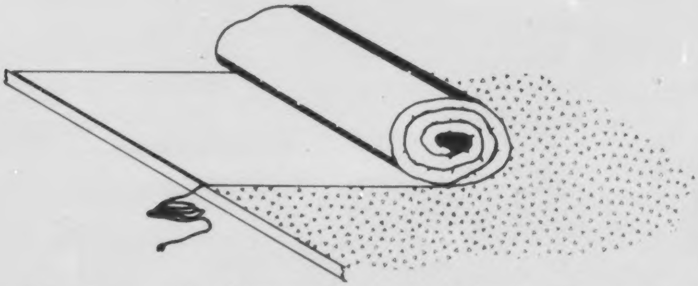
Tarpolins



Visqueen



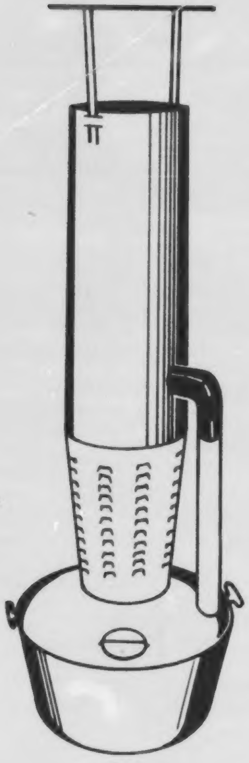
Insulated Blankets



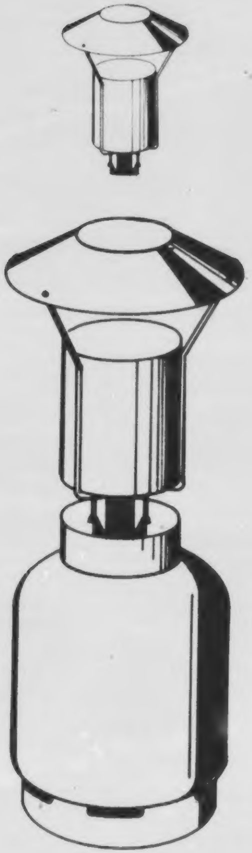
Electrically Heated Insulated Blankets

Cold Weather Protection

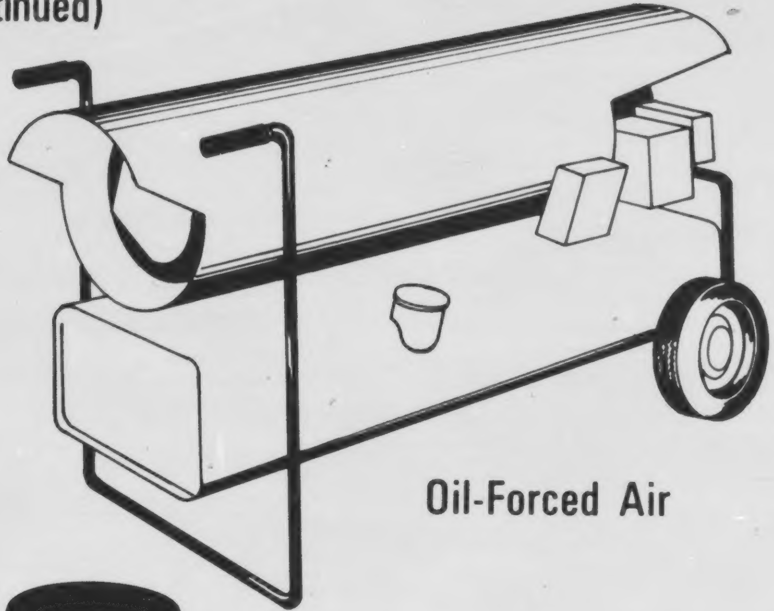
(Continued)



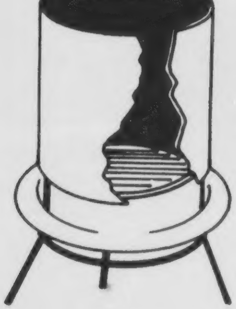
Oil
Salamander



Gas
Salamander

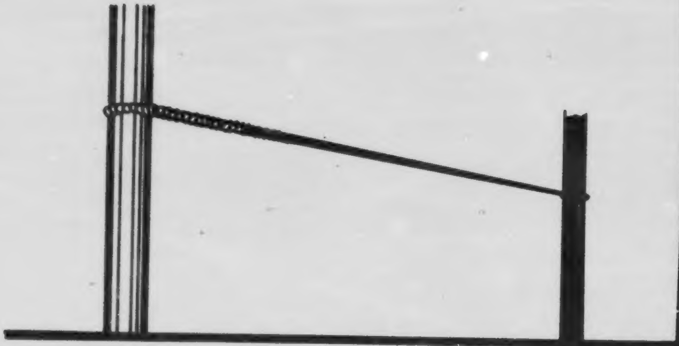


Oil-Forced Air

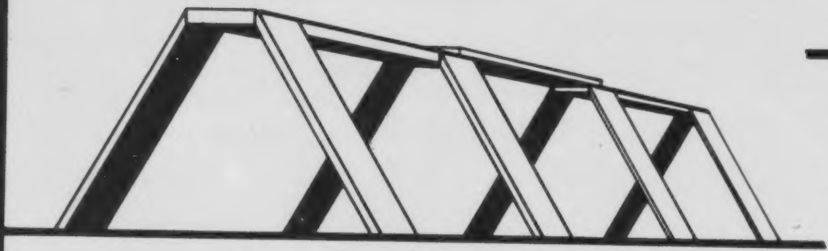


Coke Burning
Salamander

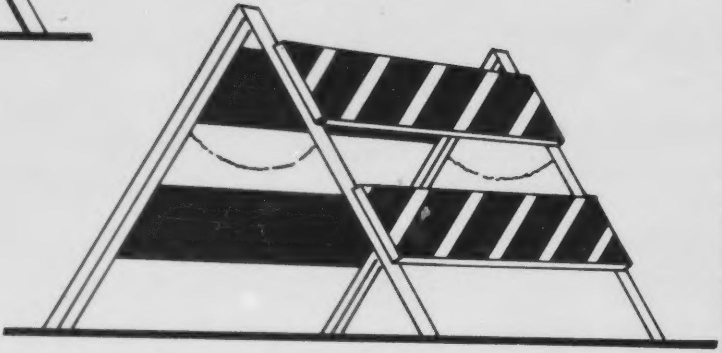
Physical Protection



Rope



Sawhorses



Commercial Barricade

PROTECTION
UNIT II

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Plant where concrete is mixed

______b. Polyethylene or other waterproof material placed on subgrade

______c. Soil prepared and compacted to support a structure or a pavement system

______d. Component added at time of mixing and developed to mix with concrete for specific purpose

______e. Obstruction set up to protect concrete

______f. Material used to enclose area around a concrete pour, usually to keep out cold and retain heat

______g. Panel (usually opaque polyethylene) set up to shield sun rays from fresh concrete

______h. Protection or barricade set up to protect concrete from physical damage

______i. Panel (usually polyethylene) set up to block wind from blowing across fresh concrete

______j. Barricade with electric blinkers attached

______k. Curing blanket, usually fiberglass encased in a moisture-proof cover of coated plastic or canvas

______l. Admixture used to slow down set of concrete

______m. Portable stove or heater usually fired by coke or fuel oil

______n. Compound sprayed on fresh concrete to reduce rapid evaporation

______o. Agent that speeds the set of concrete

1. Physical protection
2. Sun shield
3. Barricade
4. Subgrade
5. Batch plant
6. Wind shield
7. Enclosure
8. Admixture
9. Vapor barrier
10. Retarder
11. Monomolecular film
12. Insulating blanket
13. Salamander
14. Commercial barricade
15. Accelerator

2. Name three types of concrete protection.

   a.

   b.

   c.

3. Select from the list below the reasons for protecting concrete in hot weather. Circle the correct letters.

   a. Slow set

   b. Rapid evaporation

   c. High winds

   d. Slow strength gain

   e. High temperature

   f. Premature setting

4. Name five methods for protecting concrete in hot weather.

   a.

   b.

   c.

   d.

   e.

5. List three reasons for protecting concrete in cold weather.

   a.

   b.

   c.

6. Name three methods for protecting concrete in cold weather.

   a.

   b.

   c.

7. Select from the list below precautions to take when protecting concrete during cold weather. Circle the correct letters.

   a. Walk on concrete when covering it

   b. Be sure heaters are vented

   c. Be sure the enclosure is airtight when using salamanders

   d. Make sure enclosures are well braced against high winds

   e. Make sure edges are not covered

   f. Do not let covering drag across freshly finished concrete

   g. Spread straw evenly about two or three inches deep

8. Select from the list below temperatures at which it is necessary to provide hot or cold weather protection. Place an "X" in the correct blanks.

   _____a. 60°F

   _____b. 40°F

   _____c. 90°F

   _____d. 80°F

9. Name four types of physical protection.

   a.

   b.

   c.

   d.

10. Name four reasons for using physical protection.

   a.

   b.

   c.

   d.

11. Select from the list below different methods of physical protection. Circle the correct letters.

    a. Set sawhorses and barricades across slab

    b. Stretch rope around perimeter of pour

    c. Stretch wire about five feet high around perimeter of pour

    d. When barricading an approach, place blinkers in middle of road

    e. Build barricade from lumber and place around perimeter of poured area

PROTECTION
UNIT II

ANSWERS TO TEST

1.
    - a. 5
    - b. 9
    - c. 4
    - d. 8
    - e. 3
    - f. 7
    - g. 2
    - h. 1
    - i. 6
    - j. 14
    - k. 12
    - l. 10
    - m. 13
    - n. 11
    - o. 15
2.
    - a. Hot weather protection
    - b. Cold weather protection
    - c. Physical protection
3. b, c, e, f
4. Any five of the following are acceptable.
    - a. Use a retarder in the concrete
    - b. Wet down subgrade and forms
    - c. Cover fresh concrete as soon as possible or apply a monomolecular film
    - d. Use cold water in mix
    - e. Set up wind and sun shields
    - f. Spray concrete with a fine mist
    - g. Use vapor barrier under slab
5.
    - a. Freezing
    - b. Slow set
    - c. Slow strength gain
6.
    - a. Coverings
    - b. Enclosures
    - c. Heaters
7. b, d, f

8. b, c
9. a. Commercial barricade
   b. Sawhorse
   c. Lumber
   d. Rope
10. a. Vandals
    b. Animals
    c. People
    d. Vehicles
11. b, e

CEMENT MASON'S

PROGRESS CHART

Section G
Curing and Protection

	UNIT I Curing			UNIT II Protection																
	1	2	3	1	2	3														
Job	UNIT TEST			UNIT TEST																
Student's Name																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct			85% Correct																
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

BLUEPRINT READING
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match terms associated with blueprint reading to the definitions and match drawing symbols to pictures of the symbols. He should be able to identify the alphabet of lines and types of architectural drawings. He should be able to read an architect's scale and list items included in a set of specifications. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with blueprint reading to a list of definitions.
2. Identify five types of architectural drawings.
3. Identify the eight types of lines included in the alphabet of lines.
4. Match the names of drawing symbols to pictures of the symbols.
5. Read the measurements on a given architect's scale.
6. List major items that should be included in a set of specifications.
7. Demonstrate the ability to:
    a. Read the architect's scale.
    b. Read a blueprint.
    c. Read plan view.
    d. Read details.
    e. Interpret curb details.

BLUEPRINT READING
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide student with objective sheet.

   B. Provide student with information and assignment sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheets.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Plot Plan

      2. TM 2--Foundation Plan

      3. TM 3--Floor Plan

      4. TM 4--Elevations

      5. TM 5--Details

6. TM 6--Details (Continued)
7. TM 7--Alphabet of Lines
8. TM 8--Alphabet of Lines (Continued)
9. TM 9--Floor Plan Symbols
10. TM 10--Section Symbols
11. TM 11--Architect's Scale
12. TM 12--Comparison of Solid Objects

D. Assignment sheets

1. Assignment Sheet #1--Read the Architect's Scale Using the Full Scale or (12" = 12")
2. Assignment Sheet #2--Read the Architect's Scale Using the Half Scale or (6" = 12")
3. Assignment Sheet #3--Read the Architect's Scale Using the One-Fourth Scale or (3" = 12")
4. Assignment Sheet #4--Read the Architect's Scale Using the One-Eighth Scale or (1 1/2" = 12")
5. Assignment Sheet #5--Read a Blueprint
6. Assignment Sheet #6--Read Plan View
7. Assignment Sheet #7--Read Details
8. Assignment Sheet #8--Interpret Curb Details

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. French, Thomas E. and Charles J. Vierch. *Engineering Drawing.* New York: McGraw-Hill, 1966.

B. Hartman, William J. *Basic Drafting.* Stillwater: Oklahoma State Department of Vocational and Technical Education, 1972.

C. Hepler, Donald E. and Paul L. Wallach. *Architectural Drafting and Design.* New York: McGraw-Hill, 1971.

D. Hornung, William J. *Architectural Drafting.* Englewood Cliffs: Prentice Hall, 1949.

BLUEPRINT READING
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Alphabet of lines--Set of conventional symbols covering all the lines needed to depict an object as to size and shape

B. Architect's scale--Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

Examples: 1/8, 1/4, 3/8, 1/2, 3/4, 1 1/2, and 3 inches to the foot

C. Architectural drawings--Graphic representation shown with lines and symbols

D. Shop drawing--Plans showing detailed information of specific items

E. Blueprint--Copy of the original detailed drawing

F. Detail--Drawing that gives complete detailed information for an element of construction

G. Dimensions--Arrangement of lines and symbols to indicate the actual size for constructing the object that is represented

H. Elevation--Drawings representing the front, sides, or rear face of a structure and usually made as though the observer were looking straight at it

I. Plan view--In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans

J. Scale drawing--Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

K. Section--Drawing of an object that has been cut to show internal construction

L. Specifications--Detailed set of written instructions which explains the drawing, describes materials and equipment used in the structure as to quality and type, and becomes part of the contract

M. Symbol--Arbitrary sign that has been standardized and is used to represent an object, quality, or method

INFORMATION SHEET

II. Types of architectural drawings (Transparencies 1, 2, 3, 4, 5, and 6)

A. Plot plan--Characteristics include:

1. Location of the structure on the site
2. Finished and existing grade contours
3. Property lines
4. Utilities
5. Location of existing conditions

(NOTE: This would include trees, buildings, or other structures.)

B. Foundation plan--Characteristics include location and size of footings, grade beams, foundation walls, stemwalls, and piers

C. Floor plan--Characteristics include:

1. Outside walls including the location and dimensions of all exterior openings
2. Type of construction through the use of symbols
3. Location of interior walls and partitions
4. Location and swing of doors
5. Stairways
6. Location of cabinets and other built-ins

D. Elevations--Characteristics include grade lines, floor heights, window size, roof line, or other dimensions

(NOTE: Elevations are shown for all faces of the structure.)

E. Details--Characteristics include:

(NOTE: These drawings are primarily used to depict details of construction that are too small or not shown in sufficient detail on the plan or elevation drawings. They may be full size or to a larger scale than the plan, elevation, or sectional view.)

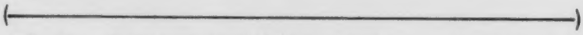
1. Windows
2. Mill work

INFORMATION SHEET

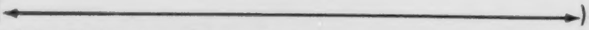
3. Ornamental iron
4. Doors
5. Built-ins
6. Door frames
7. Stairs
8. Walls and partitions

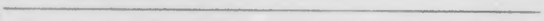
(NOTE: Sections are used freely on these drawings.)

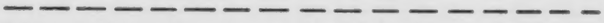
III. Alphabet of lines (Transparencies 7 and 8)

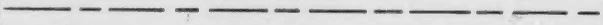
A. Object lines ()--Show the main outline of the structure including exterior walls, interior partitions, porches, patios, driveways, and interior walls

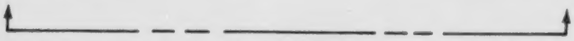
(NOTE: These lines should be the outstanding lines on the drawing.)

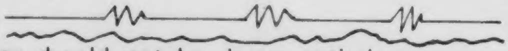
B. Dimension lines ()--Thin unbroken lines which designate dimensions

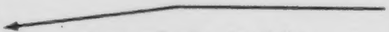
C. Extension lines ()--Extend but do not touch the object lines and permit dimension lines to be drawn between them

D. Hidden line ()--Short dashes used to show lines that are not visible from that view

E. Center lines ()--Series of short and long dashes used to designate centers and provide a reference point for dimensioning

F. Section lines ()--Heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning

G. Break lines ()--Used when an area cannot or should not be drawn entirely

H. Leaders ()--Used to connect a note or dimension to a part of the building

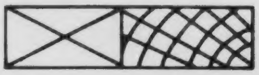
INFORMATION SHEET

IV. Drawing symbols (Transparencies 9 and 10)

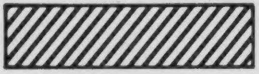
(NOTE: Check architect's drawings for symbols.)

A. Floor plan

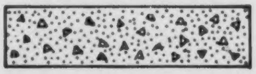
1. Wood (rough)



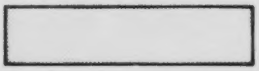
2. Brick



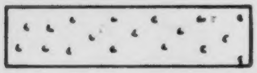
3. Concrete



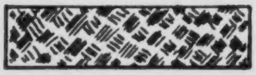
4. Sand, plaster, cement, gypsum board



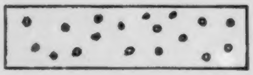
5. Cinders



6. Earth

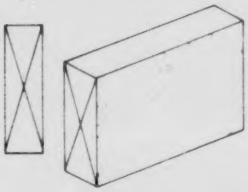


7. Gravel

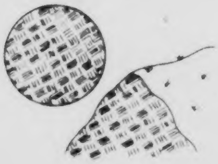


B. Section

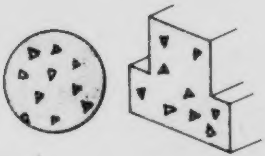
1. Rough lumber



2. Earth



3. Concrete



INFORMATION SHEET

V. Architect's scale (Transparencies 11 and 12)

A. Rules for reading a scale

1. Select proper scale ratio
2. Be sure scale is laying flat on the surface being measured
3. Double check all measurements
4. Practice measuring from the center of one line to the center of the next line
5. Do not use a scale where dimensions are available

B. Common scales to which plans are drawn

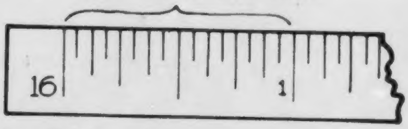
1. 12" = 1' - 0" (Full scale)
2. 6" = 1' - 0" (One-half scale)
3. 3" = 1' - 0" (One-fourth scale)
4. 1/2" = 1' - 0"
5. 1/4" = 1' - 0"
6. 1/8" = 1' - 0"

C. Interpreting graduations on the architect's scale

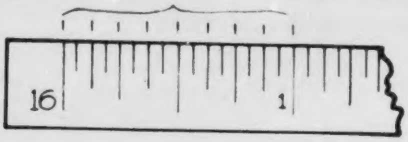
(NOTE: When measuring, be sure to use the specific scale on the architect's scale.)

1. Sixteenth scale (full scale)

a. 16 - 16ths make one inch

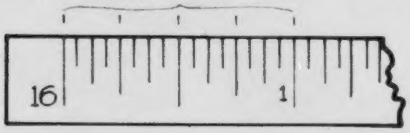


b. 8 - 8ths make one inch; 2 - 1/16" make 1/8"

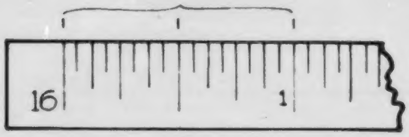


INFORMATION SHEET

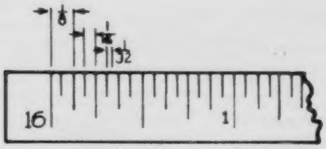
c. 4 - 4ths make one inch; 4 - 1/16" make 1/4"



d. 2 - 1/2ves make one inch; 8 - 1/16" make 1/2"



e. For 1/32" increments there are two 1/32" in one 1/16" and two 1/16" in one 1/8"



f. Dimensions are read in this order

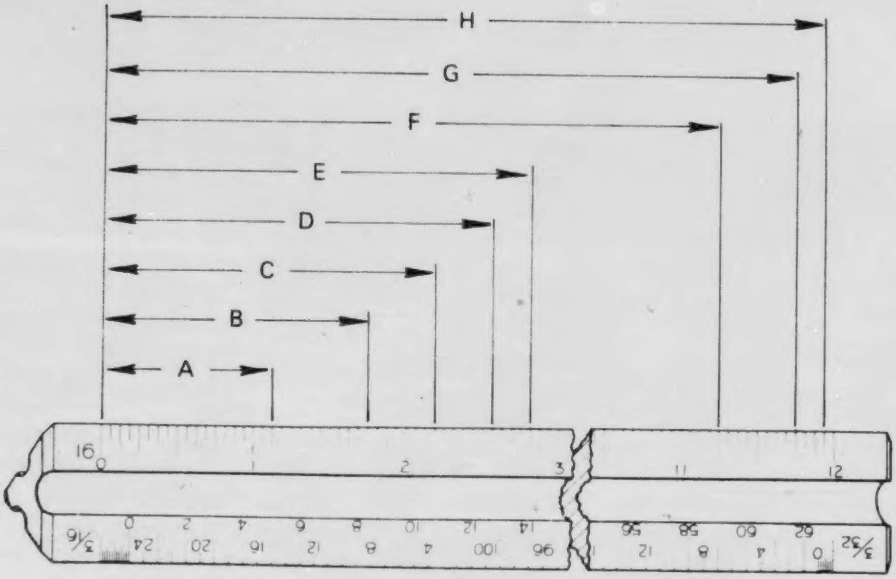
1) Feet marked thus (')

2) Inches marked thus (")

3) Fractions of an inch

INFORMATION SHEET

g. Practice reading the following dimensions in inches and 1/16" (full scale)


H
G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
0
2
4
6
8
10
12
14
24
20
16
12
8
4
100
96
56
58
60
62
12
8
4
0
3/32

1) A = 1" + 2/16" = 1 2/16" or 1 1/8"

2) B = 1" + 12/16" = 1 12/16" or 1 3/4"

3) C = 2" + 3/16" = 2 3/16"

4) D = 2" + 9/16" = 2 9/16"

5) E = 2" + 13/16" = 2 13/16"

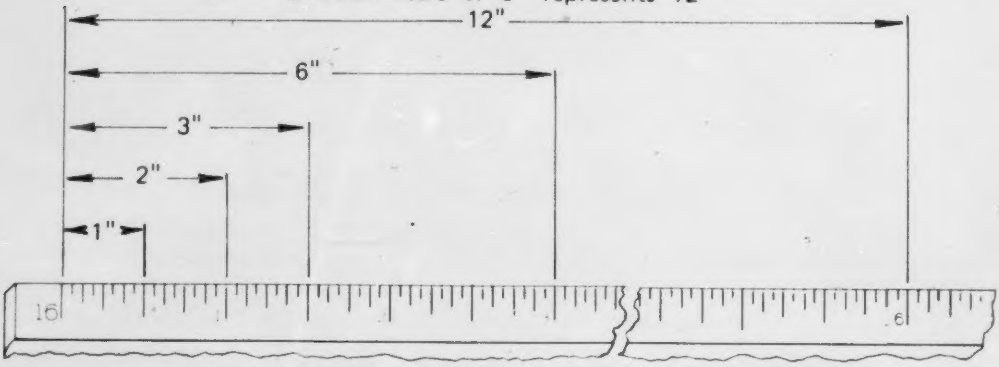
6) F = 11" + 4/16" = 11 4/16" or 11 1/4"

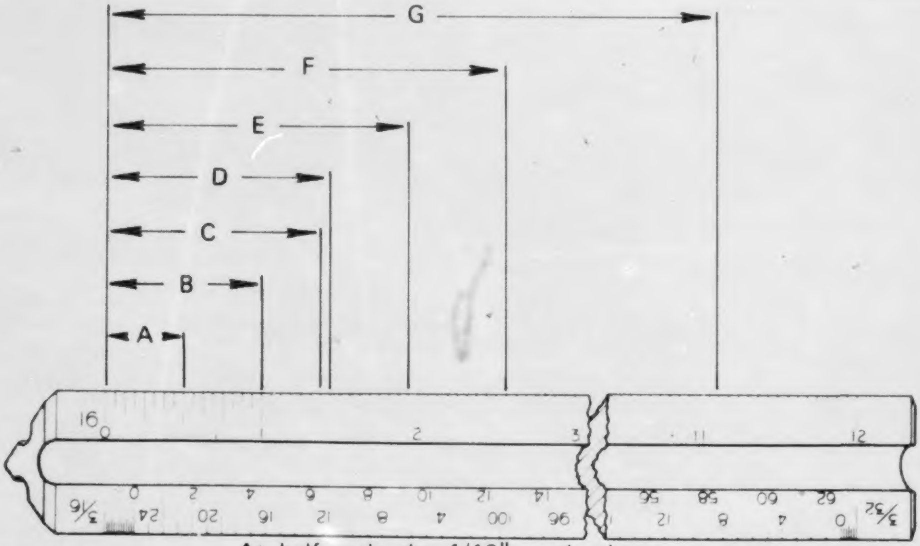
7) G = 11" + 12/16" = 11 12/16" or 11 3/4"

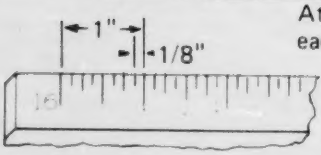
8) H = 11" + 15/16" = 11 15/16"

INFORMATION SHEET

2. One-half scale or 6" represents 12"


12"
6"
3"
2"
1"
16
1
6


G
F
E
D
C
B
A
16
0
1
2
3
11
12



At half scale the 1/16" graduations each represent 1/8"

1) A = 8/8" = 1"

2) B = 16/8" = 2"

3) C = 2" + 6/8" = 2 6/8" or 2 3/4"

4) D = 2" + 7/8" = 2 7/8"

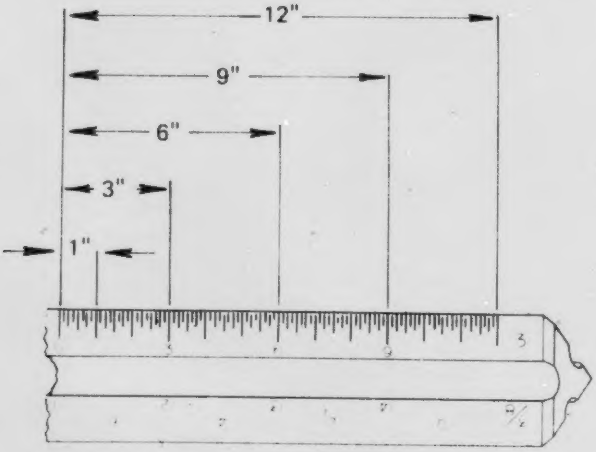
5) E = 3" + 7/8" = 3 7/8"

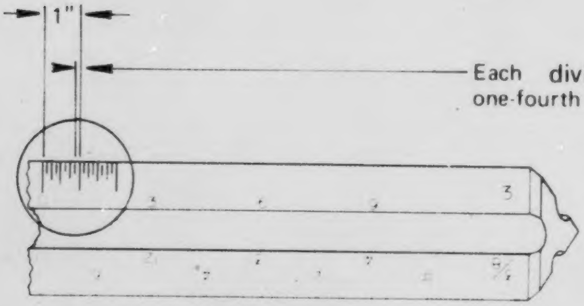
6) F = 5" + 1/8" = 5 1/8"

7) G = 22" + 2/8" = 22 2/8" or 22 1/4"

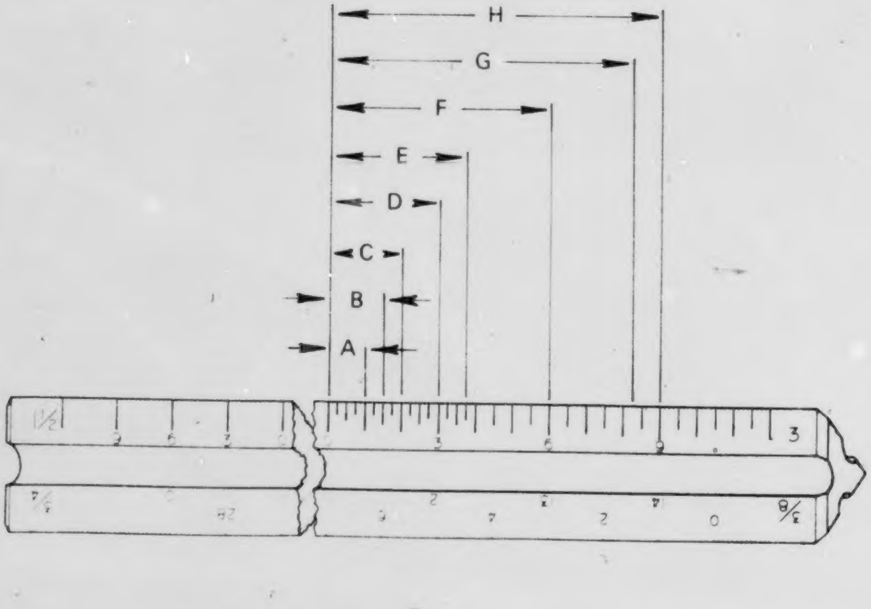
INFORMATION SHEET

3. One-fourth scale or 3" = 12"


12"
9"
6"
3"
1"
3
6
9
3
8/3



Each division equals 1/8" at one-fourth scale


H
G
F
E
D
C
B
A
1½
3
6
9
3
8/3

INFORMATION SHEET

1) A = 8 graduations = 1"

2) B = 1" + 4/8" = 1 4/8" or 1 1/2"

3) C = 1" + 8/8" = 1 8/8" or 2"

4) D = The number 3 = 3"

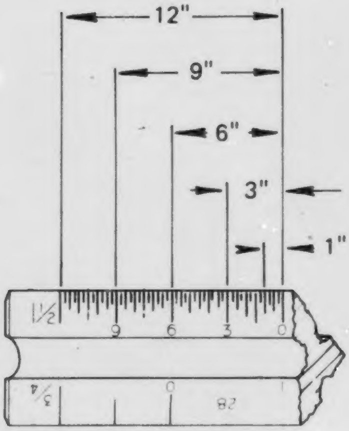
5) E = 3" + 6/8" = 3 6/8" or 3 3/4"

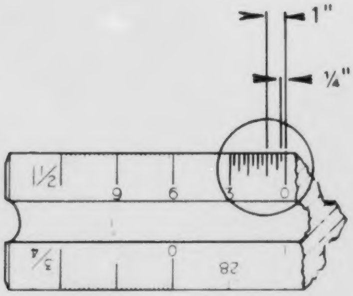
6) F = The number 6 = 6"

7) G = 8 + 2/8" = 8 2/8" or 8 1/4"

8) H = The number 9 = 9"

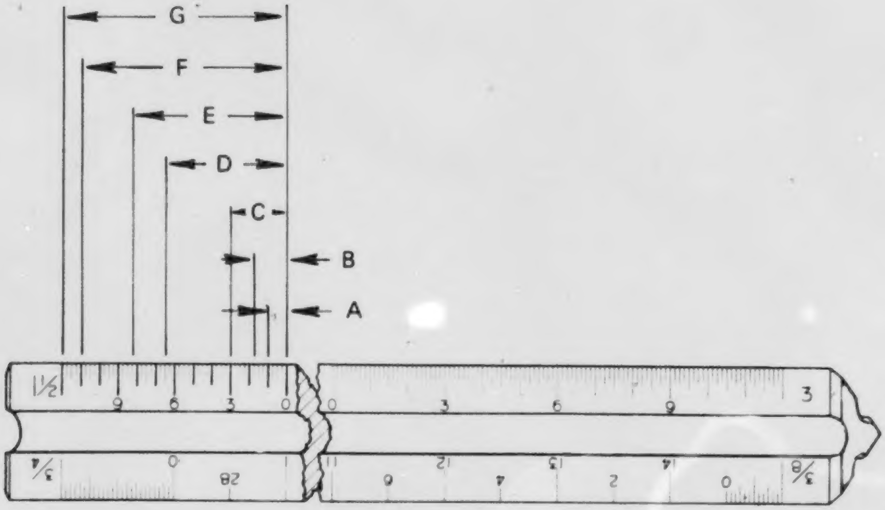
4. One-eighth scale or 1 1/2" = 12"


12"
9"
6"
3"
1"
1½
9
6
3
0
¾
0
28


1"
¼"
1½
9
6
3
0
¾
0
28

This is one inch at 1/8" scale graduated into spaces that represent 1/4"

INFORMATION SHEET


G
F
E
D
C
B
A
1½
9
6
3
0
0
3
6
9
3
¾
0
28
11
9
12
4
13
2
14
0
⅜

1) A = 8 graduations = 1"

2) B = 1" + 3/4" = 1 3/4"

3) C = The number 3 represents 3"

4) D = 6" + 2/4" = 6 2/4" or 6 1/2"

5) E = 8 + 1/4" = 8 1/4"

6) F = 2" past 9 represents 11"

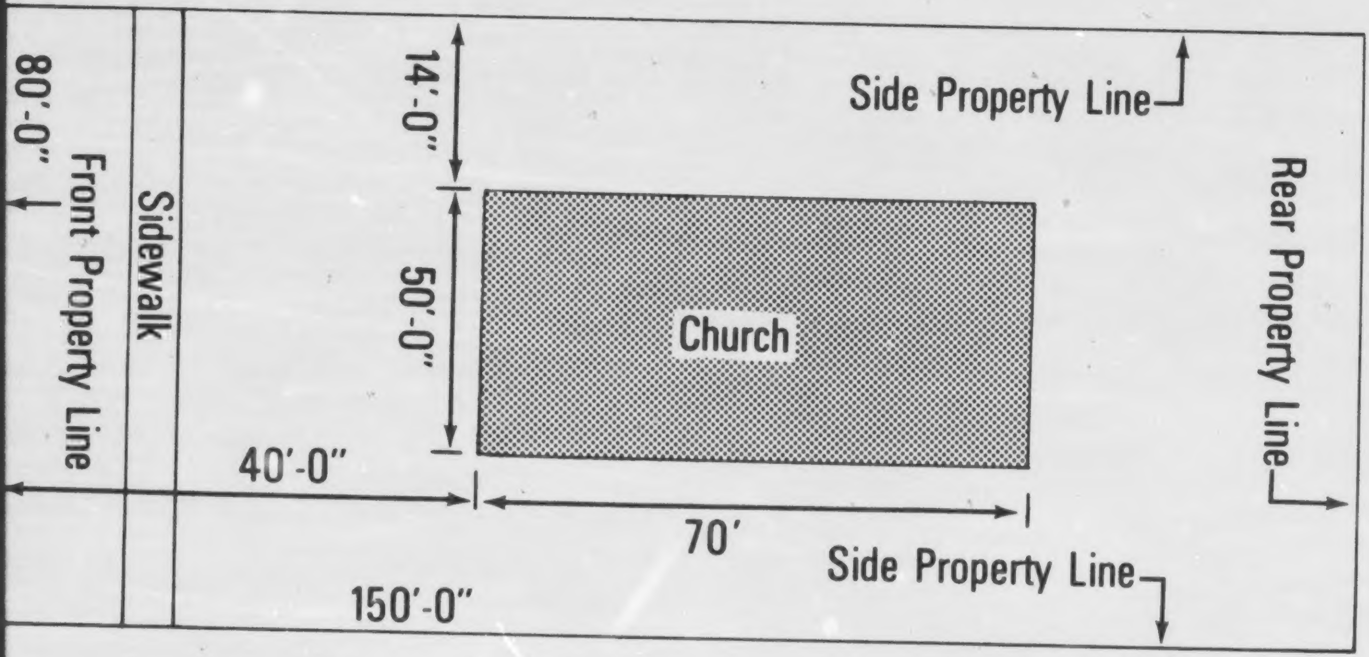
7) G = 1 1/2" represents 12"

INFORMATION SHEET

VI. Items included in a set of specifications

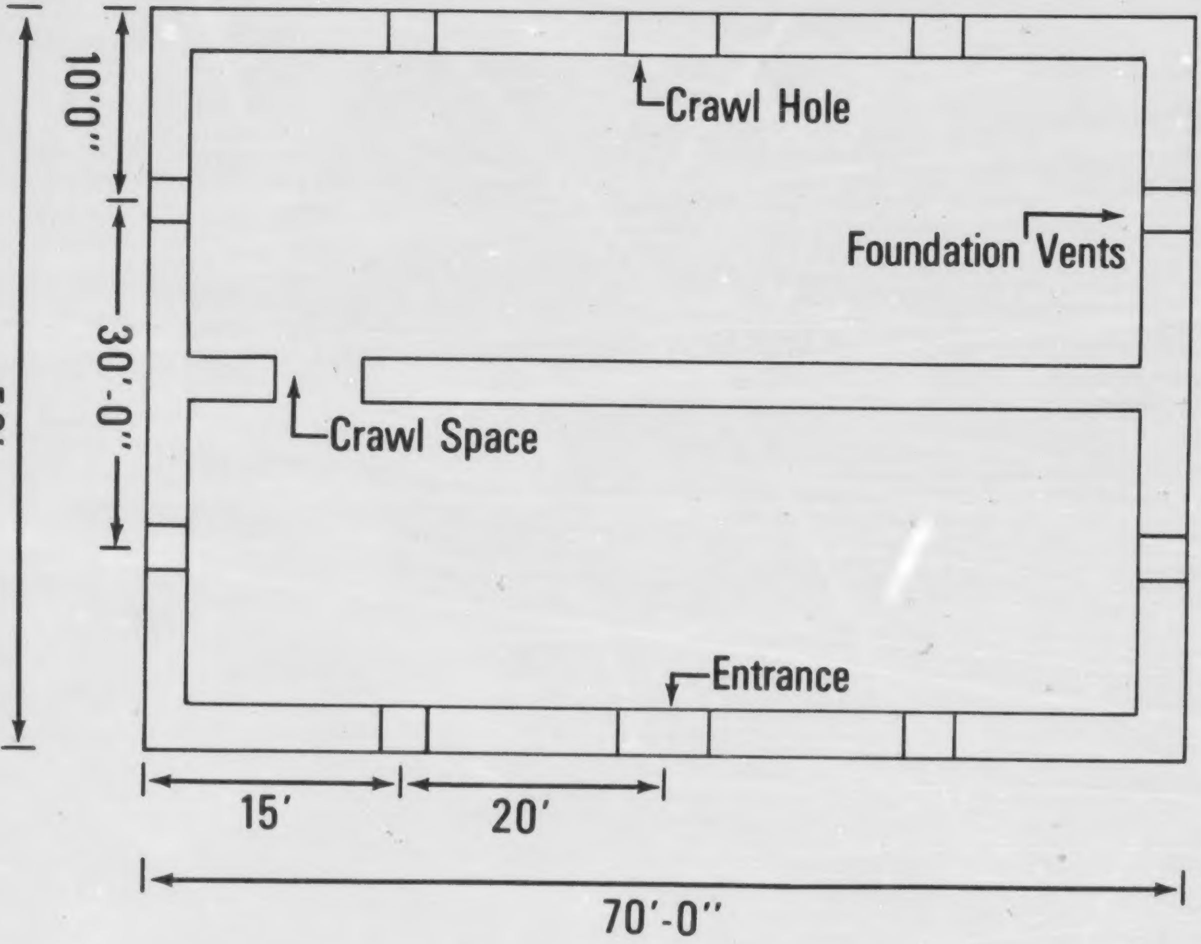
- A. Sizes
- B. Types and quality of building materials
- C. Concrete finishes
- D. Method of construction
- E. Slump of concrete
- F. Concrete test
- G. Types of concrete
- H. Tolerances

Plot Plan

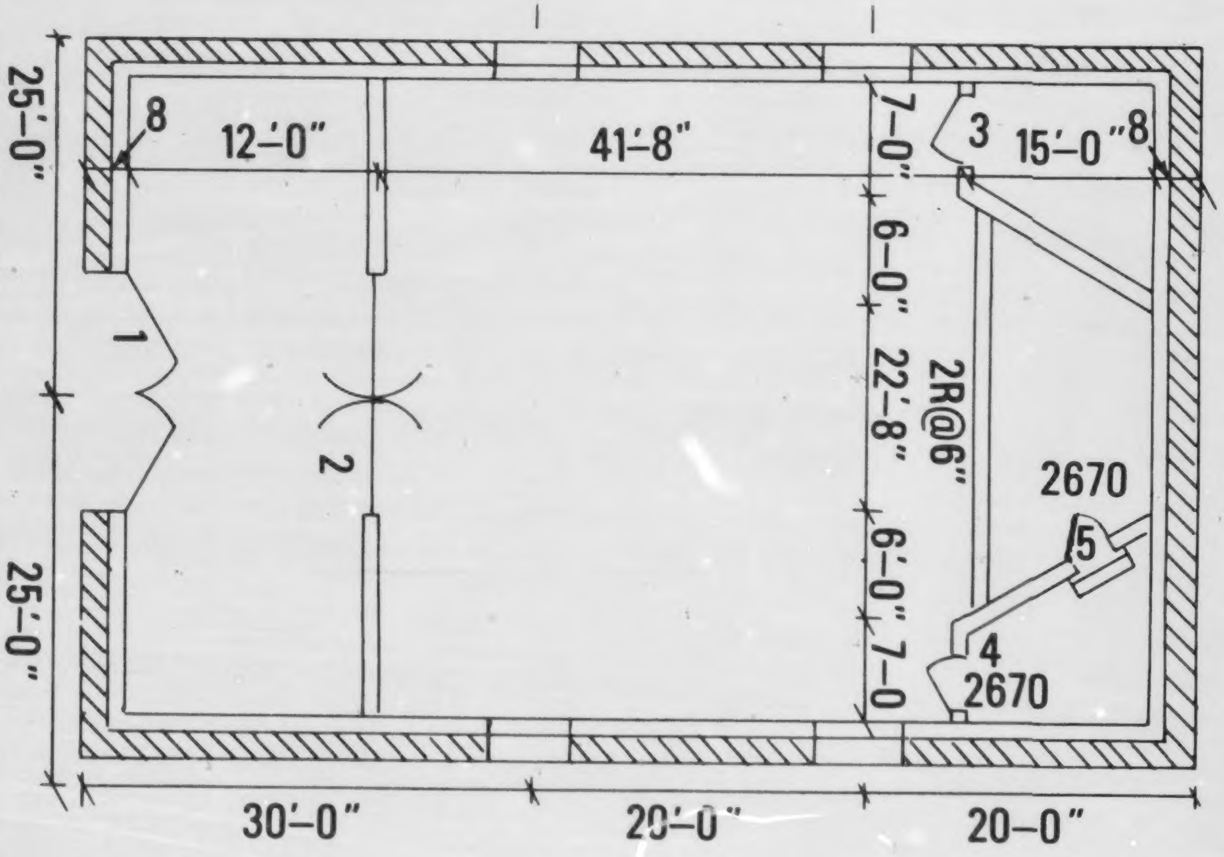


Side Property Line
14'-0"
80'-0"
Front Property Line
Sidewalk
50'-0"
Church
Rear Property Line
40'-0"
70'
Side Property Line
150'-0"

Foundation Plan

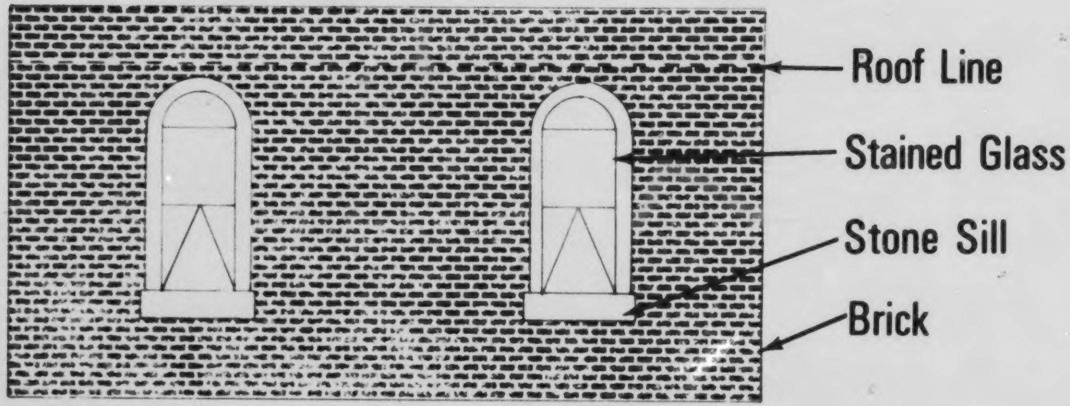

10'0"
Crawl Hole
Foundation Vents
30'-0"
50'
Crawl Space
Entrance
15'
20'
70'-0"

Floor Plan

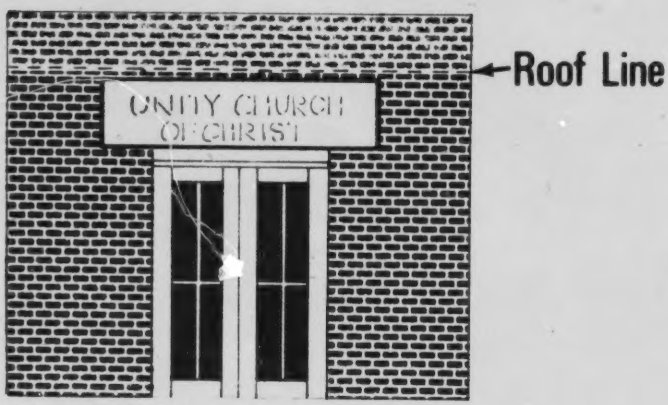


25'-0"
8
12'-0"
41'-8"
7-0"
3
15'-0"
8
6-0"
1
22'-8"
2R@6"
2
2670
5
6'-0"
4
7-0
2670
25'-0"
30'-0"
20'-0"
20-0"

Elevations

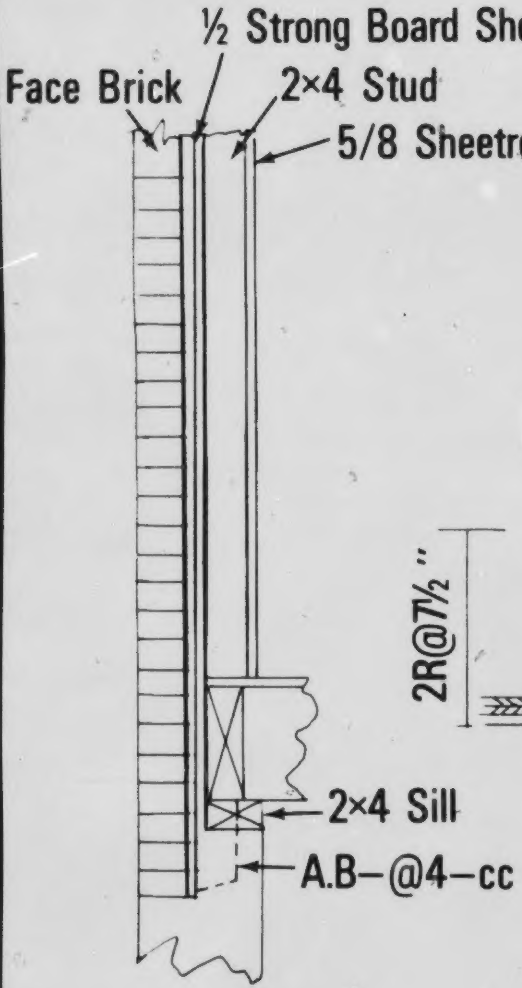

Roof Line
Stained Glass
Stone Sill
Brick

RIGHT SIDE (Left Side Similar)

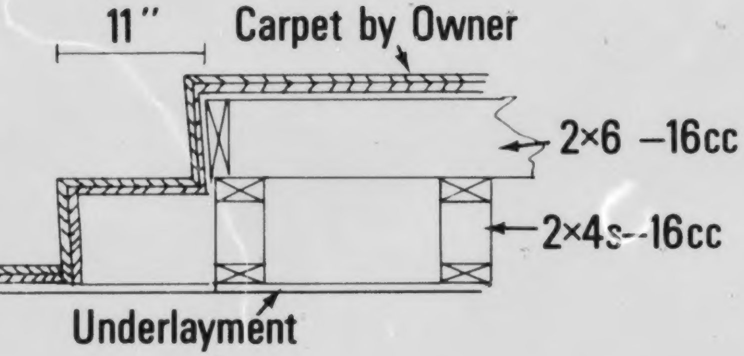

Roof Line
UNITY CHURCH
OF CHRIST

FRONT

Details


½ Strong Board Sheathing
Face Brick
2×4 Stud
5/8 Sheetrock
2×4 Sill
A.B–@4–cc

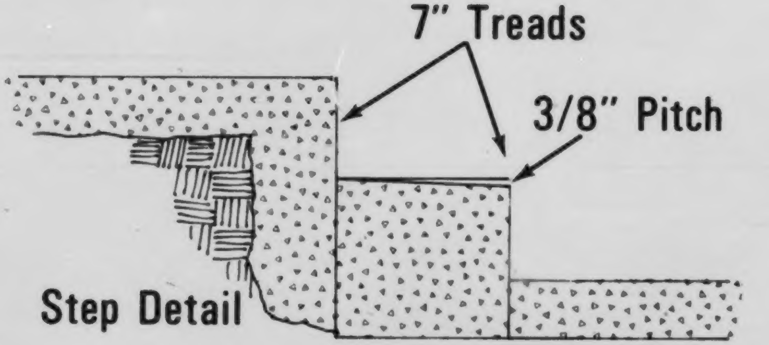
Typical Exterior Wall


11″
Carpet by Owner
2R@7½″
2×6 –16cc
2×4s--16cc
Underlayment

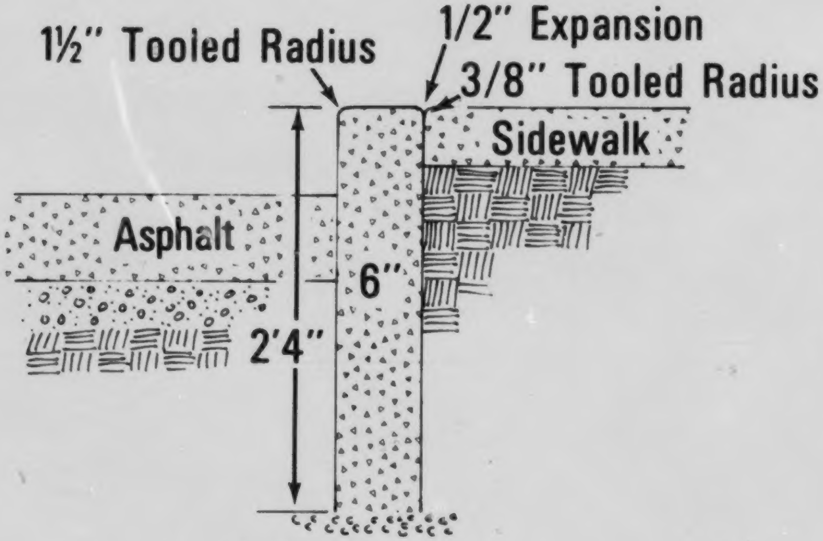
Stair and Platform

Scale 1″=1′-0″

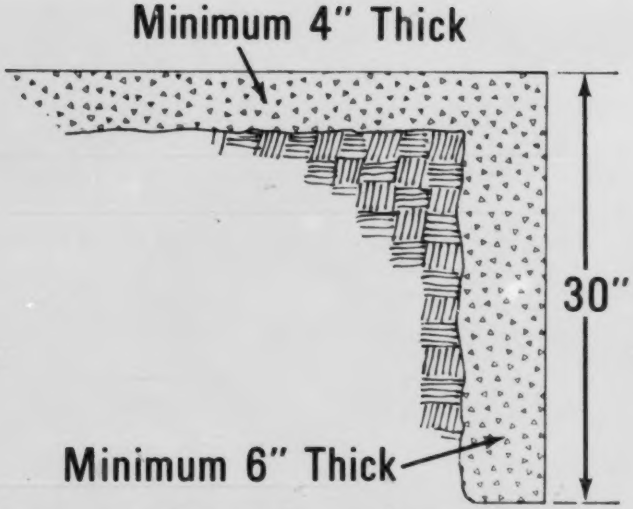
Details
(Continued)


7" Treads
3/8" Pitch

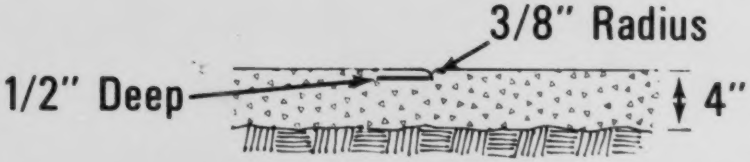
Step Detail


1½" Tooled Radius
1/2" Expansion
3/8" Tooled Radius
Sidewalk
Asphalt
6"
2'4"

Curb Detail


Minimum 4" Thick
30"
Minimum 6" Thick

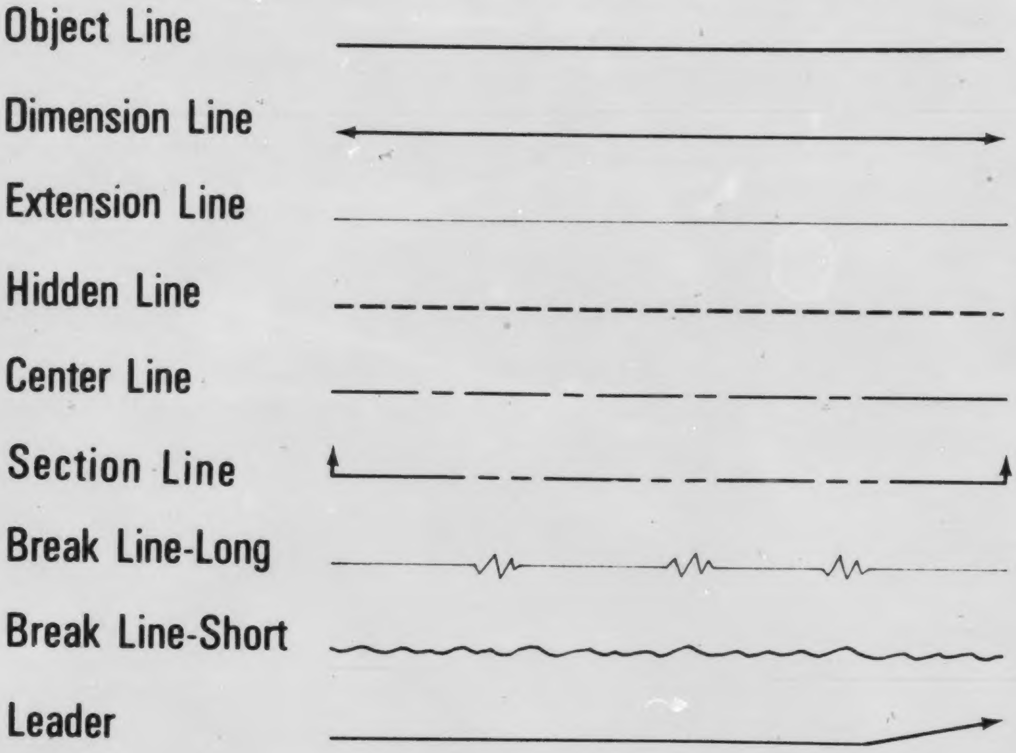
Front and Rear Stoop Concrete Detail


3/8" Radius
1/2" Deep
4"

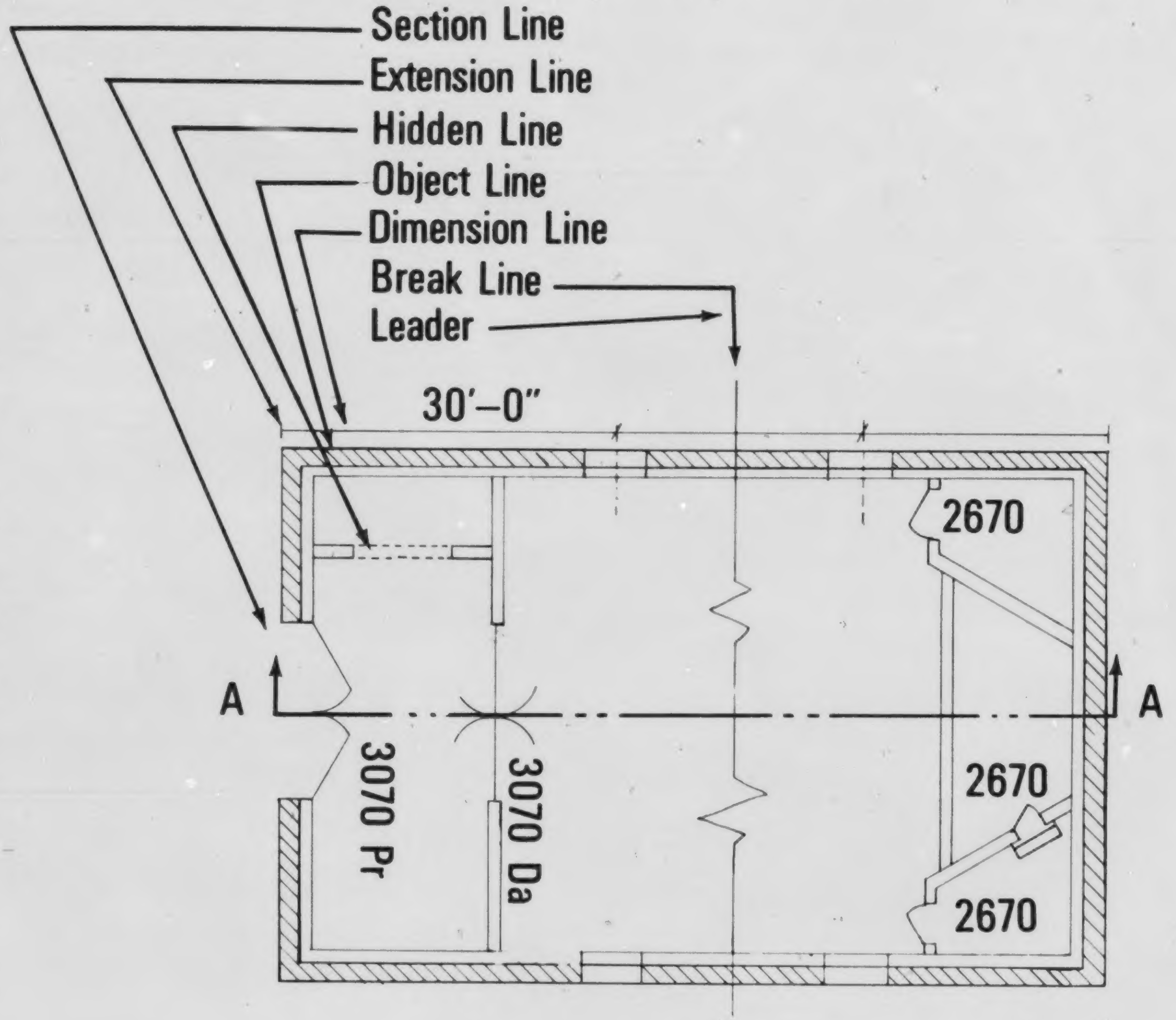
Typical Joint Detail

Scale-1"=1'0"

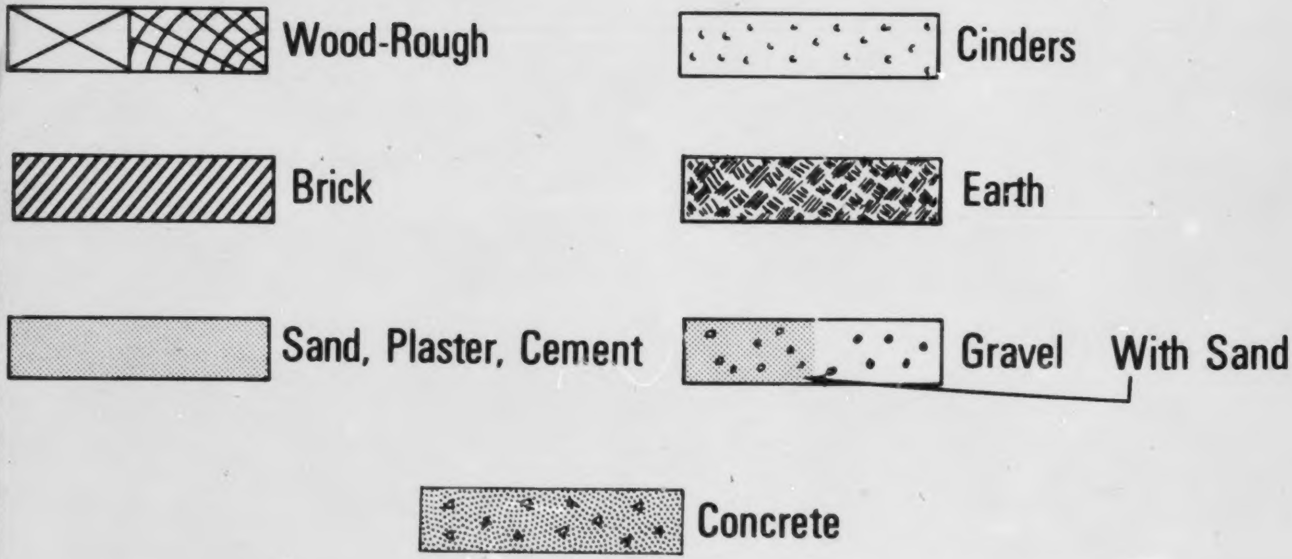
Alphabet of Lines


Object Line
Dimension Line
Extension Line
Hidden Line
Center Line
Section Line
Break Line-Long
Break Line-Short
Leader

Alphabet of Lines (Continued)


Section Line
Extension Line
Hidden Line
Object Line
Dimension Line
Break Line
Leader
30'–0"
2670
A
A
3070 Pr
3070 Da
2670
2670

Floor Plan Symbols



Wood-Rough

Cinders

Brick

Earth

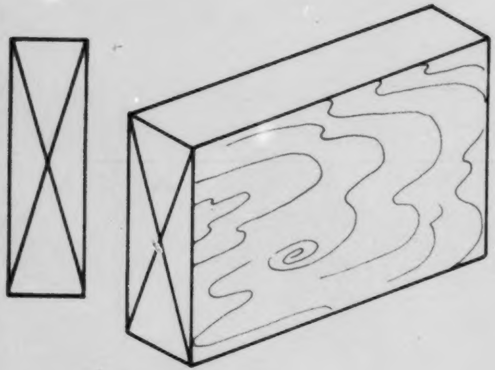
Sand, Plaster, Cement

Gravel

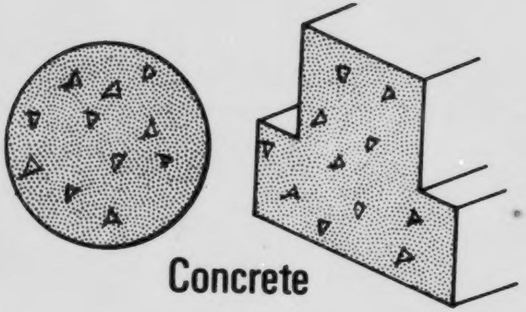
With Sand

Concrete

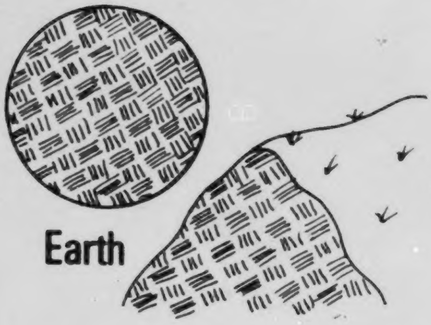
Section Symbols



Rough Lumber

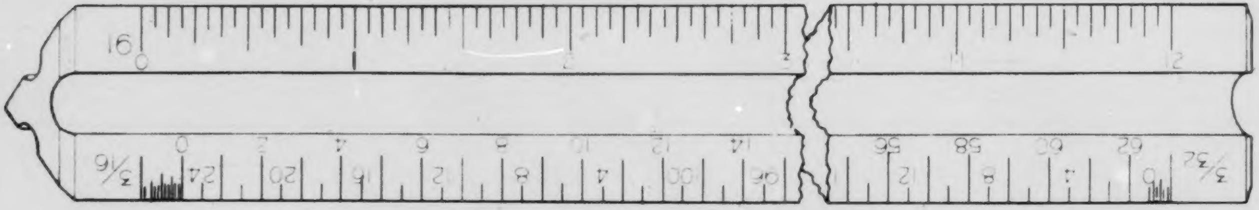


Concrete

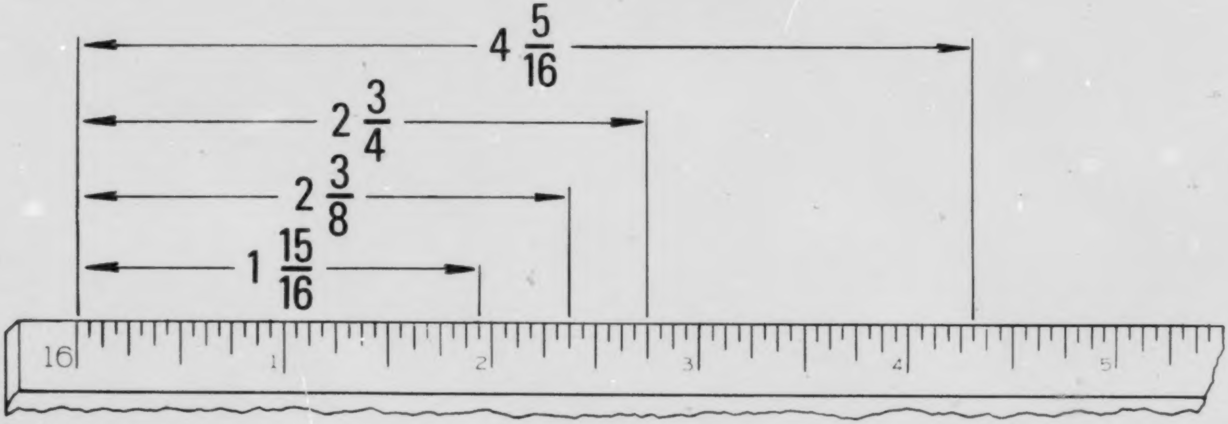


Earth

Architect's Scale

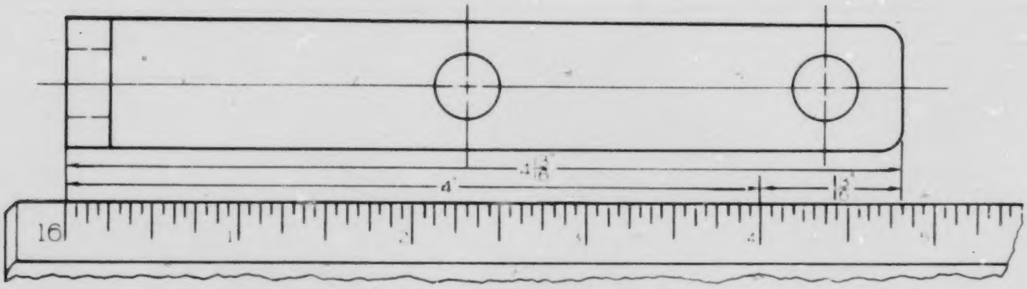


This is how the Architect's Scale should look.

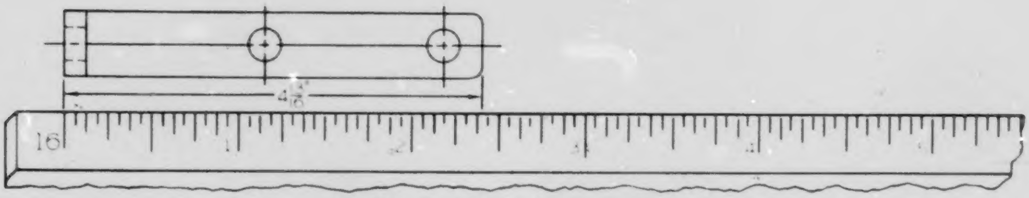

4 5/16
2 3/4
2 3/8
1 15/16
16
1
2
3
4
5

Measurements at Scale of 12" = 1'-0"

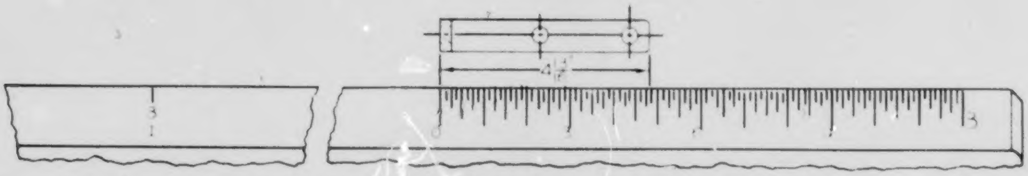
Comparison of Solid Objects


4 3/16"
4"
1 3/16"
16

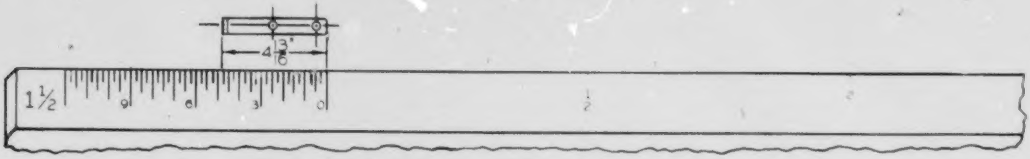
Full Scale 12" = 1'-0"



Half Scale 6" = 1'-0"



One-Fourth Scale 3" = 1'-0"

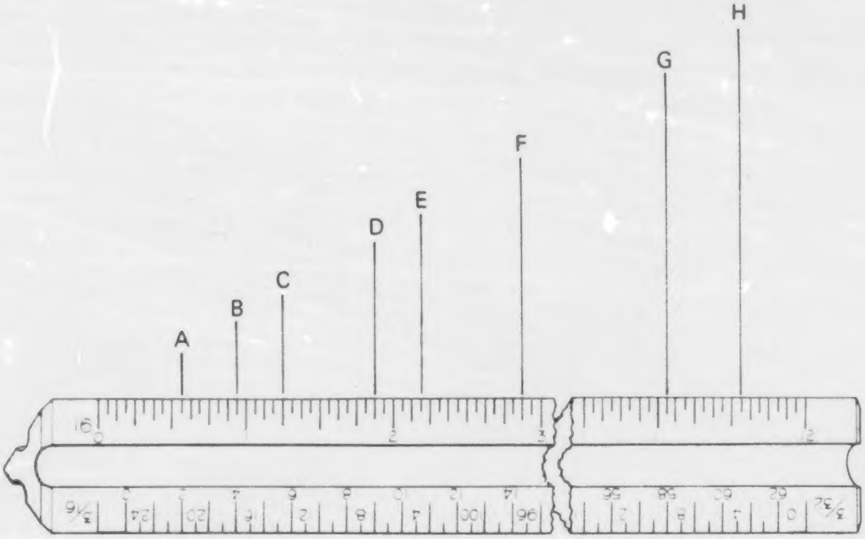

4 3/16"
1½
9
6
3
0

One-Eighth Scale 1½" = 1'-0"

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #1--READ THE ARCHITECT'S SCALE USING FULL SCALE OR (12" = 12")

Read the measurements shown below at full scale by reading the distance from "0" at left to points indicated on the scale with letters.

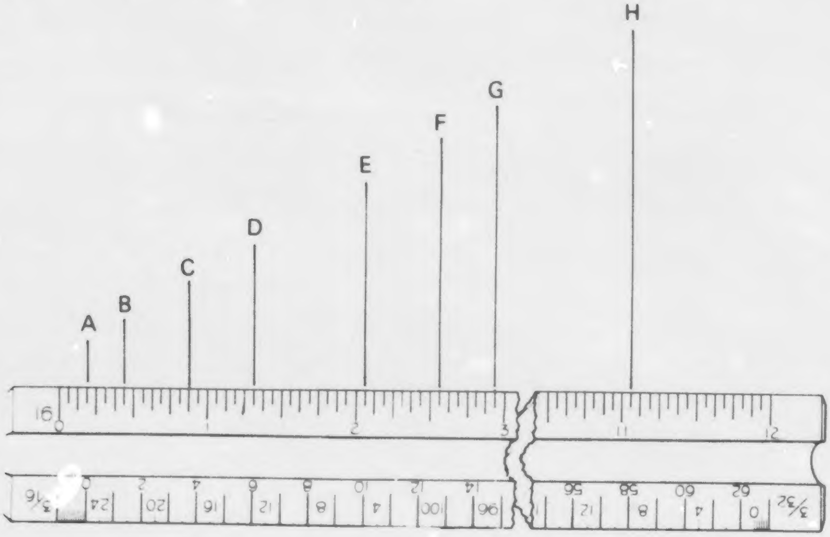


1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #2--READ THE ARCHITECT'S SCALE USING HALF SCALE OR (6" = 12")

Read the measurements shown below at half scale by reading the distance from "0" at left to points indicated on the scale with letters.


H
G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
3/32

1. A =

2. B =

3. C =

4. D =

5. E =

6. F =

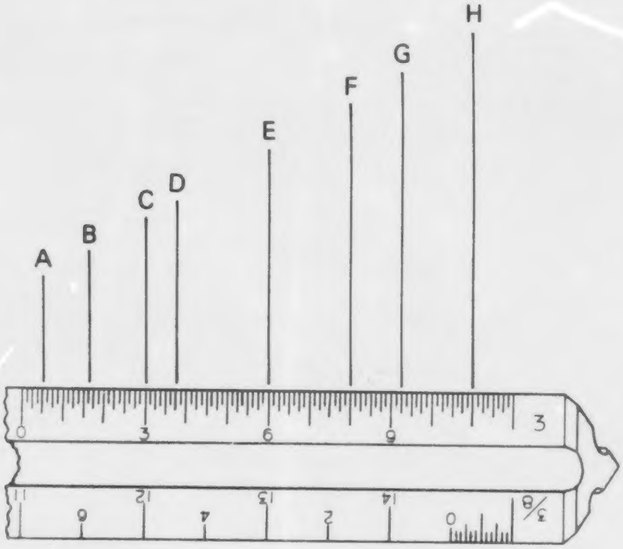
7. G =

8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #3--READ THE ARCHITECT'S SCALE USING ONE-FOURTH SCALE OR (3" = 12")

Read the one-fourth scale shown below by reading the distance from "0" at left to points indicated on the scale with letters.


A
B
C
D
E
F
G
H
0
3
6
9
3
11
6
12
4
13
2
14
0
3/8

1. A =

2. B =

3. C =

4. D =

5. E =

6. F =

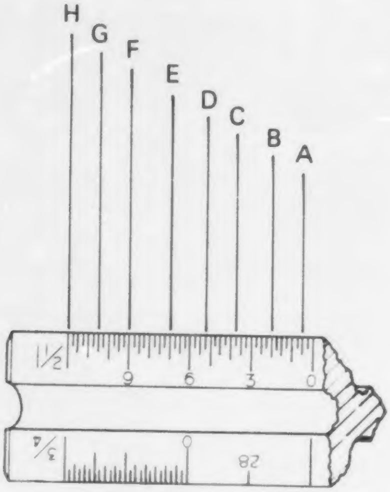
7. G =

8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #4--READ THE ARCHITECT'S SCALE USING ONE-EIGHTH SCALE OR (1 1/2" = 12")

Read the one-eighth scale shown below by reading the distance from "0" at right to points indicated on the scale with letters.



1. A =

2. B =

3. C =

4. D =

5. E =

6. F =

7. G =

8. H =

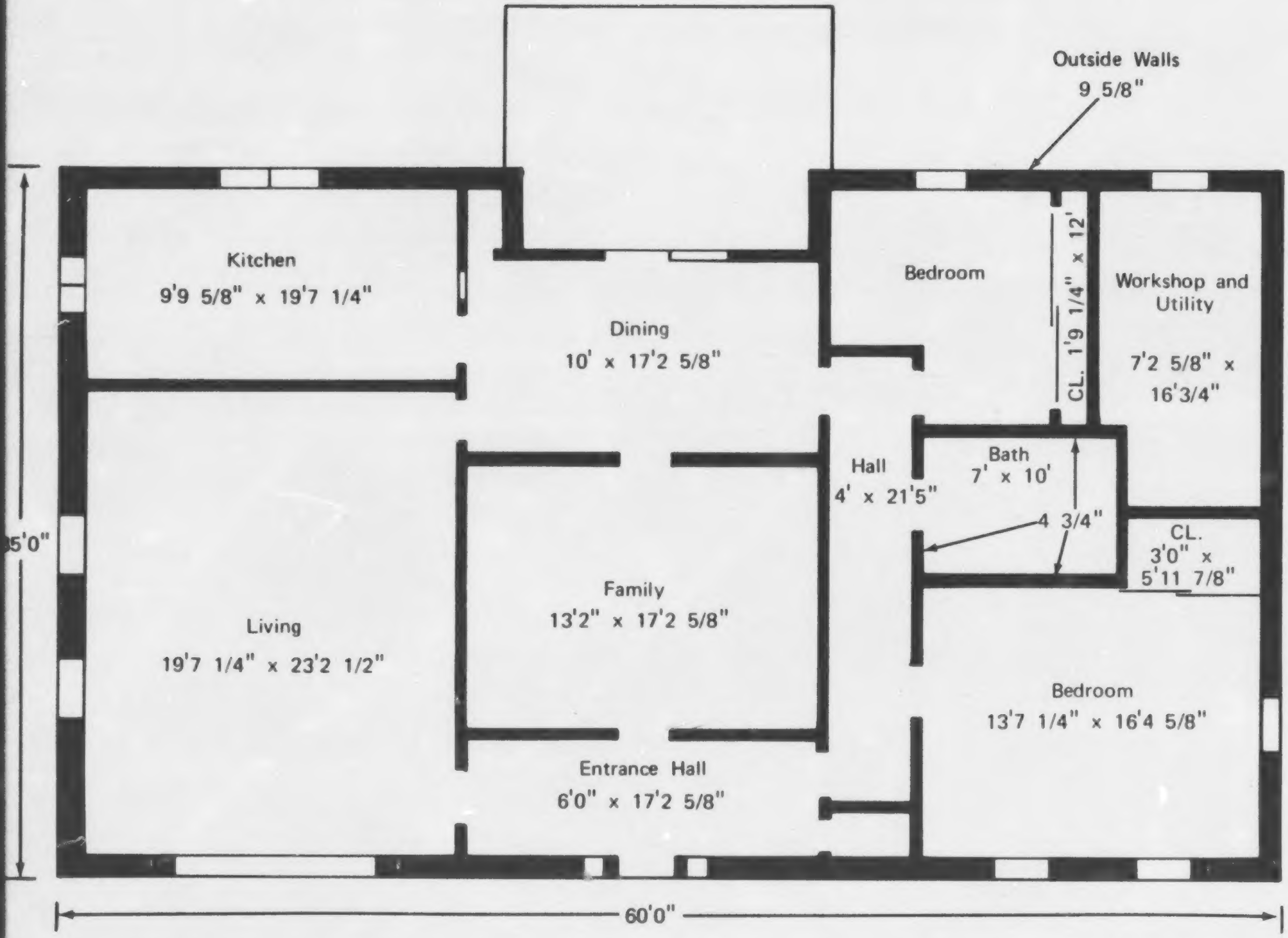
BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #5--READ A BLUEPRINT

Using the plans on the following page, complete the dimensions below.

1. Using 1/8" scale, give the dimensions of the patio
   a. Width--
   b. Length--
2. State the size of the house
   a. Width--
   b. Length--
3. Give the dimensions of the small bedroom
   a. Width--
   b. Length--

ASSIGNMENT SHEET #5


Outside Walls
9 5/8"
Kitchen
9'9 5/8" x 19'7 1/4"
Dining
10' x 17'2 5/8"
Bedroom
CL. 1'9 1/4" x 12'
Workshop and Utility
7'2 5/8" x 16'3/4"
Bath
7' x 10'
Hall
4' x 21'5"
4 3/4"
CL.
3'0" x 5'11 7/8"
5'0"
Family
13'2" x 17'2 5/8"
Living
19'7 1/4" x 23'2 1/2"
Bedroom
13'7 1/4" x 16'4 5/8"
Entrance Hall
6'0" x 17'2 5/8"
60'0"

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #6--READ PLAN VIEW

Use Diagram 1 on the following page to complete questions 1-3.

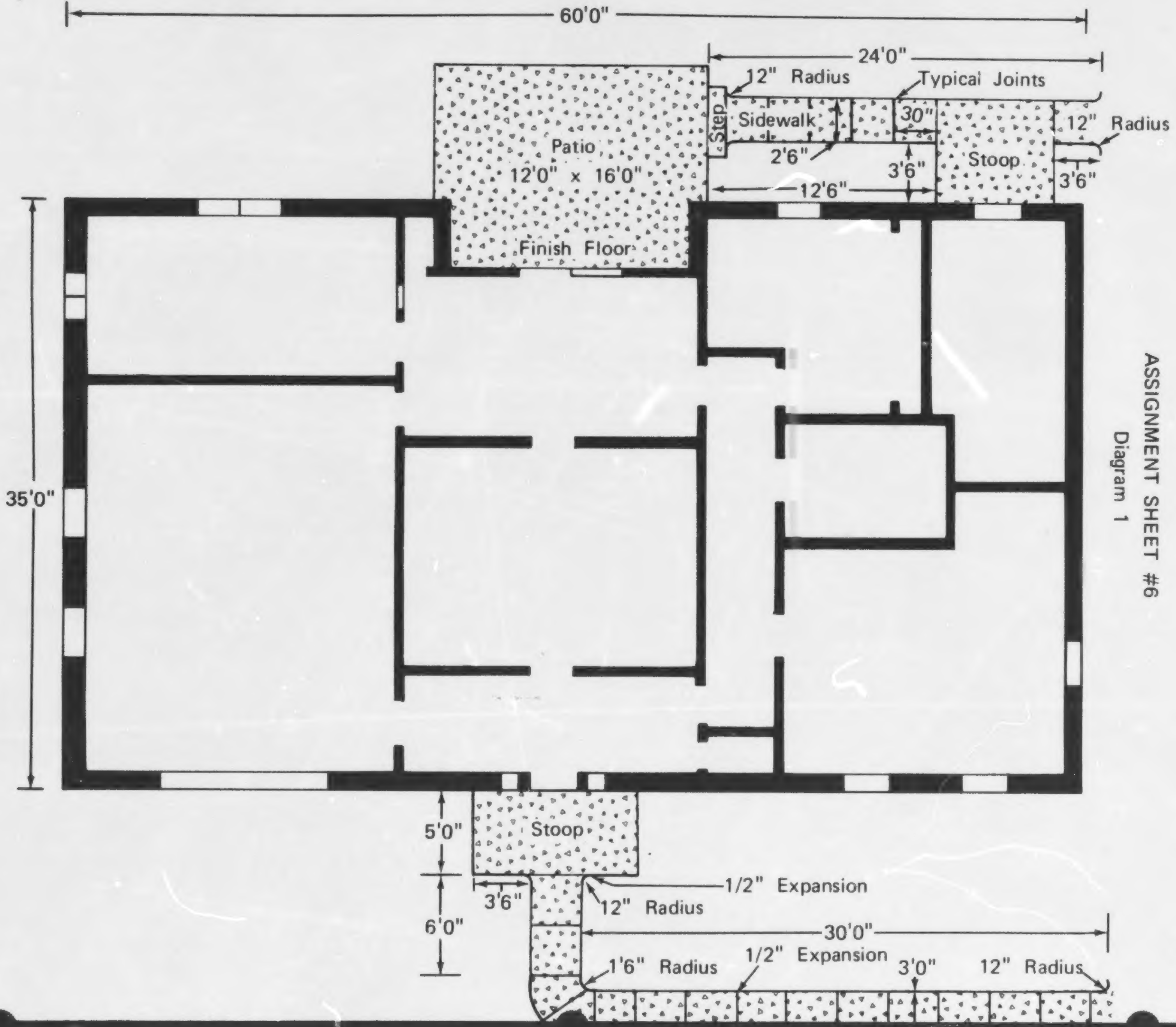
1. What item is missing that is essential before starting to build?
2. Linear feet of sidewalk
   a. Front--
   b. Rear--
3. Size of stoops
   a. Front--
   b. Rear--

Use Diagram 2 for questions 4 and 5.

4. What is the distance between each expansion on the city sidewalk?
5. How far apart are the joints on city sidewalk?

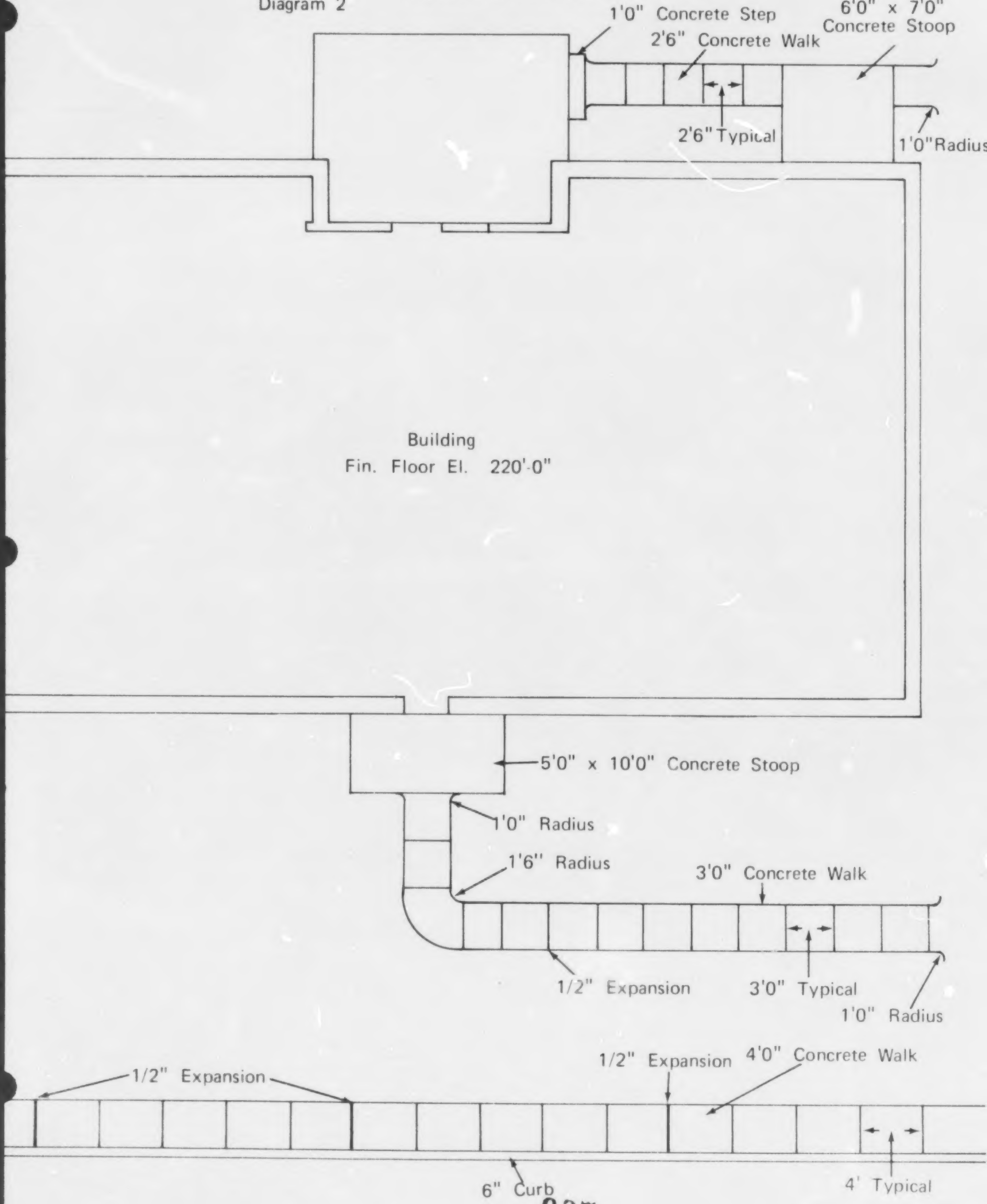
ASSIGNMENT SHEET #6

Diagram 1


60'0"
24'0"
12" Radius
Typical Joints
Step
Sidewalk
30"
12" Radius
2'6"
Stoop
3'6"
3'6"
12'6"
Patio
12'0" x 16'0"
Finish Floor
35'0"
5'0"
Stoop
1/2" Expansion
3'6"
12" Radius
6'0"
30'0"
1'6" Radius
1/2" Expansion
3'0"
12" Radius

ASSIGNMENT SHEET #6

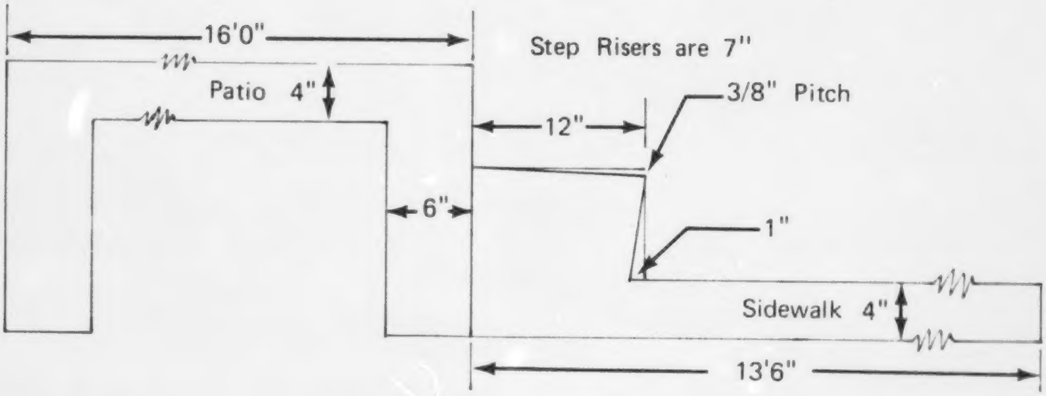
Diagram 2


1'0" Concrete Step
2'6" Concrete Walk
6'0" x 7'0" Concrete Stoop
2'6" Typical
1'0"Radiu
Building
Fin. Floor El. 220'-0"
5'0" x 10'0" Concrete Stoop
1'0" Radius
1'6" Radius
3'0" Concrete Walk
1/2" Expansion
3'0" Typical
1'0" Radius
1/2" Expansion
1/2" Expansion
4'0" Concrete Walk
6" Curb
4' Typical

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #7--READ DETAILS

From the drawing below, list dimensions of the patio, sidewalk, step, and patio footing.


16'0"
Step Risers are 7"
Patio 4"
3/8" Pitch
12"
6"
1"
Sidewalk 4"
13'6"

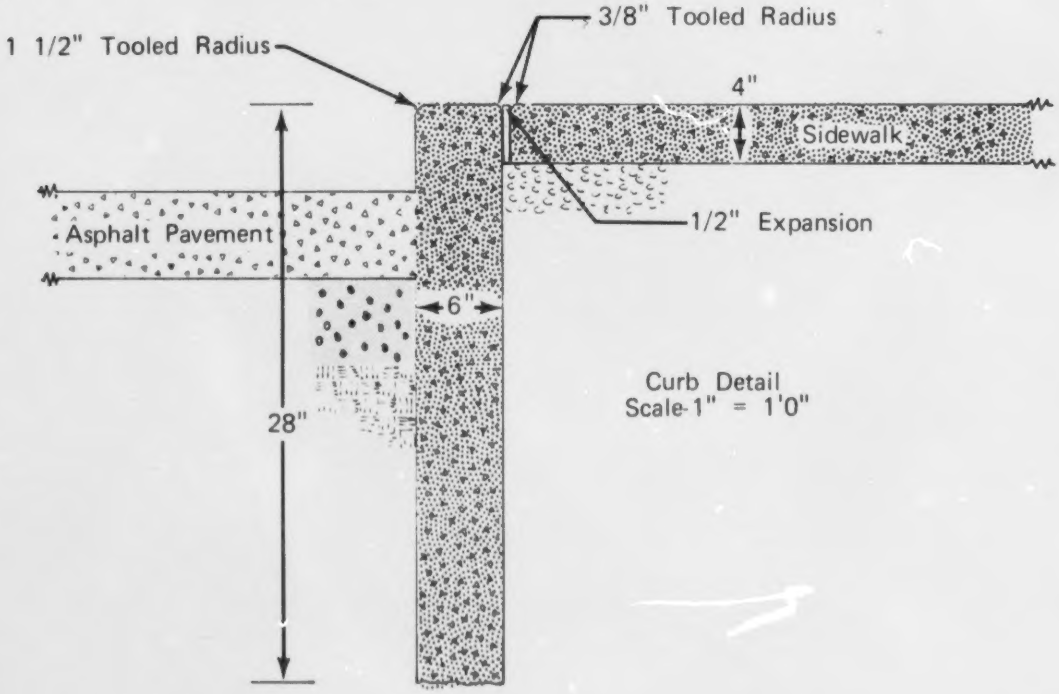
Step Detail
Scale - 1" = 1'0"

1. Patio--
2. Sidewalk--
3. Step--
4. Patio footing--

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #8--INTERPRET CURB DETAILS

1. From the drawing below, list five different materials shown.


3/8" Tooled Radius
1 1/2" Tooled Radius
4"
Sidewalk
Asphalt Pavement
1/2" Expansion
6"
28"
Curb Detail
Scale-1" = 1'0"

a.

b.

c.

d.

e.

2. List the different types of lines that are used.

a.

b.

c.

d.

e.

BLUEPRINT READING
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 9/16"
2. 15/16"
3. 1 1/4"
4. 1 7/8"
5. 2 3/16"
6. 2 7/8"
7. 11 1/16"
8. 11 9/16"

Assignment Sheet #2

1. 3/8"
2. 7/8"
3. 1 3/4"
4. 2 5/8"
5. 4 1/8"
6. 5 1/8"
7. 5 7/8"
8. 22 1/8"

Assignment Sheet #3

1. 1/2"
2. 1 5/8"
3. 3 "

4. 3 3/4"
5. 6"
6. 8"
7. 9 1/4"
8. 11"

Assignment Sheet #4

1. 1/2"
2. 2"
3. 3 3/4"
4. 5 1/4"
5. 7"
6. 9"
7. 10 1/2"
8. 12"

Assignment Sheet #5

1. a. 12' 0"
   b. 16' 0"
2. a. 35' 0"
   b. 60' 0"
3. a. 11' 0"
   b. 12' 0"

Assignment Sheet #6

1. Elevations
2. a. 40' 6"
   b. 16'

3. a. 5' x 10'
   b. 6' x 7'
4. 20'
5. 4'

Assignment Sheet #7

1. 16'0"
2. 12' 7"
3. 12"
4. 18" x 6"

Assignment Sheet #8

1. a. Concrete
   b. Cinder
   c. Expansion
   d. Gravel with sand
   e. Earth
2. a. Object
   b. Dimension
   c. Extension
   d. Break
   e. Leaders

BLUEPRINT READING
UNIT I

TEST

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Drawing of an object that has been cut to show internal construction

_____b. Detailed set of written instructions which explains the drawing, describes materials and equipment used in the structure as to quality and type, and becomes part of the contract

_____c. Arbitrary sign that has been standardized and is used to represent an object, quality, or method

_____d. Graphic representation shown with lines and symbols

_____e. Drawing that gives complete, detailed information for an element of construction

_____f. Set of conventional symbols covering all the lines needed to depict an object as to size and shape

_____g. Arrangement of lines and symbols to indicate the actual size for constructing the object that is represented

_____h. In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans

_____i. Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

_____j. Drawings representing the front, sides, or rear face of a structure and usually made as though the observer were looking straight at it

1. Alphabet of lines
2. Architect's scale
3. Architectural drawings
4. Blueprint
5. Detail
6. Dimensions
7. Elevation
8. Plan view
9. Scale drawing
10. Section
11. Specifications
12. Symbol
13. Shop drawing

______k. Copy of the original detailed drawing

______l. Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

______m. Plans showing detailed information of specific items

2. Identify the five types of architectural drawings pictured below and on the following page.

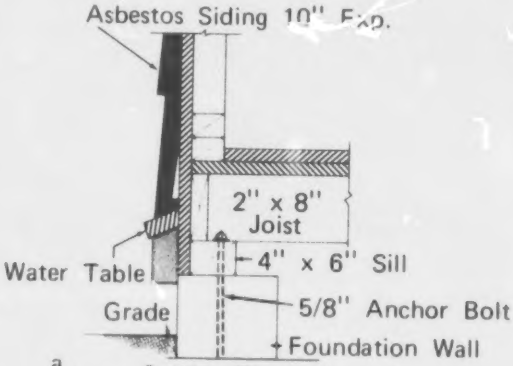
a.______________________

b.______________________

c.______________________

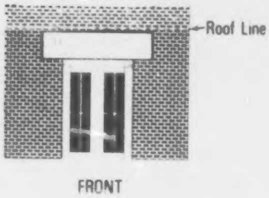
d.______________________

e.______________________

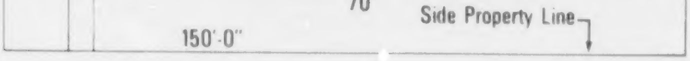

Asbestos Siding 10" Exp.
2" x 8" Joist
4" x 6" Sill
Water Table
Grade
5/8" Anchor Bolt
Foundation Wall

a. Section Thru Sill

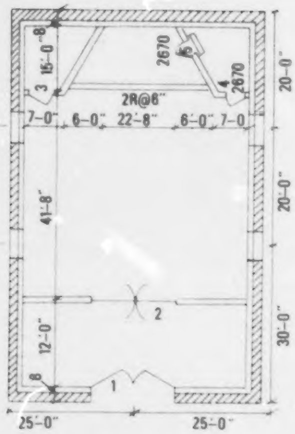
b.

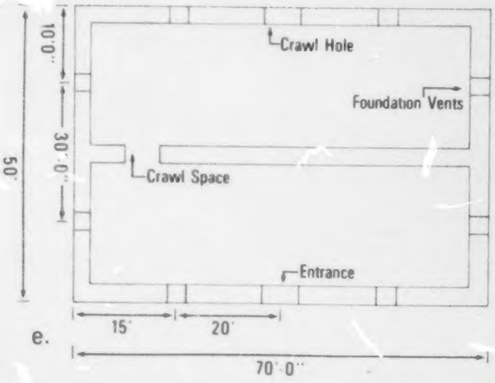

Roof Line
FRONT

c.


80'-0"
Front Property Line
Sidewalk
14'-0"
50'-0"
Church
Side Property Line
Rear Property Line
40'-0"
70'
Side Property Line
150'-0"

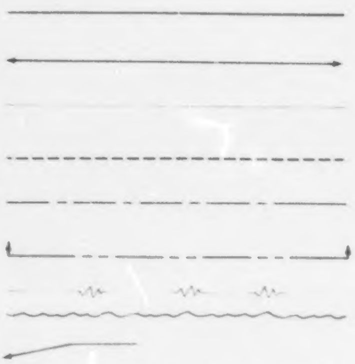
d.


15'-0" 8
3
2670
2670
4
2R@8"
7-0" 6-0" 22-8" 6-0" 7-0
41-8"
20-0"
20-0"
2
12-0"
30-0"
8
1
25-0"
25-0"


10'-0"
Crawl Hole
Foundation Vents
50'
30'-0"
Crawl Space
Entrance
15'
20'
70'-0"

e.

3. Identify the types of lines shown below.



a.____________

b.____________

c.____________

d.____________

e.____________

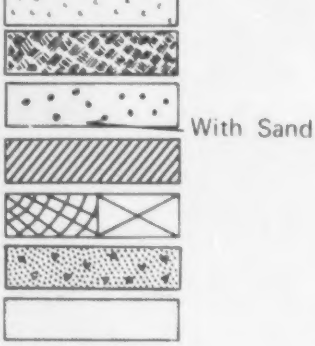
f.____________

g.____________

h.____________

4. Match the names of the drawing symbols on the right to the pictures of the symbols on the left. Place the appropriate letters in the blanks provided.

a. Floor plan



_____1)

_____2)

_____3)

_____4)

_____5)

_____6)

_____7)

a) Brick

b) Concrete

c) Earth

d) Cinders

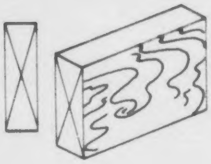
e) Sand, plaster, cement, gypsum board

f) Gravel

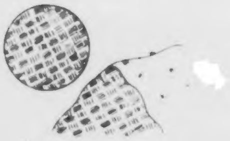
g) Wood (rough)

b. Section

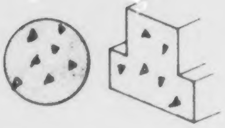
_____1)



_____2)



_____3)



a) Earth

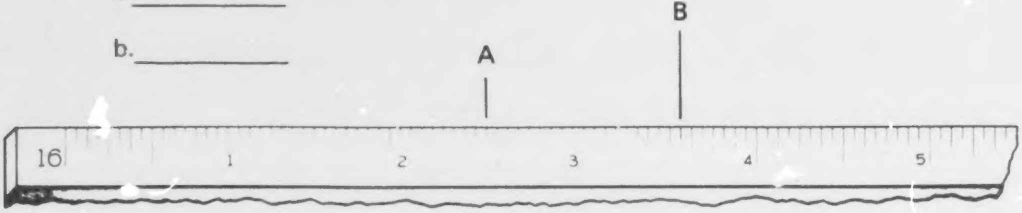
b) Concrete

c) Rough lumber

5. Read the measurements on the following scales.

a.__________

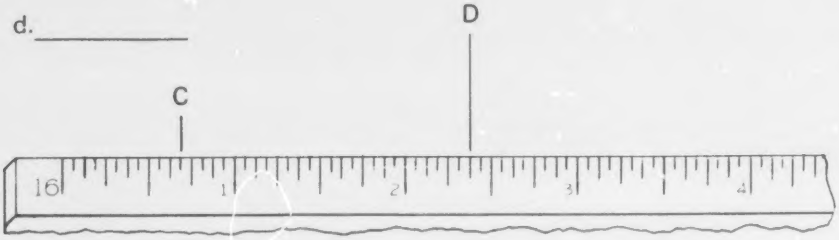
b.__________



Full Scale (12" = 12")

c.__________

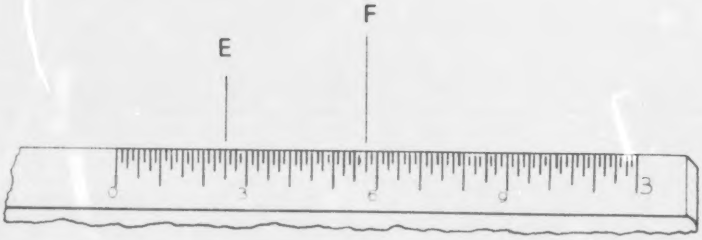
d.__________



Half Scale (6" = 12")

e. ______________

f. ______________

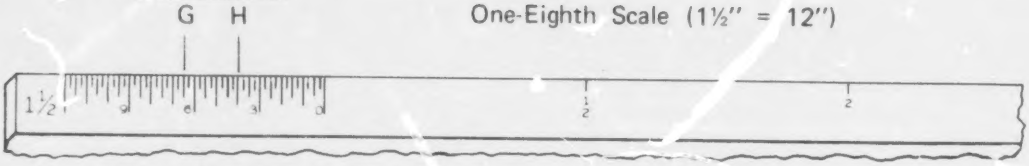


One-Fourth Scale (3" = 12")

g. ______________

h. ______________

One-Eighth Scale (1½" = 12")



6. List eight major items that should be included in a set of specifications.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

   h.

7. Demonstrate the ability to:

   a. Read the architect's scale.

   b. Read a blueprint.

   c. Read plan view.

   d. Read details.

   e. Interpret curb details.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

BLUEPRINT READING
UNIT I

ANSWERS TO TEST

1.
   - a. 10
   - b. 11
   - c. 12
   - d. 3
   - e. 5
   - f. 1
   - g. 6
   - h. 8
   - i. 2
   - j. 7
   - k. 4
   - l. 9
   - m. 13

2.
   - a. Details
   - b. Front elevation
   - c. Plot plan
   - d. Floor plan
   - e. Foundation plan

3.
   - a. Object line
   - b. Dimension line
   - c. Extension line
   - d. Hidden line
   - e. Center line
   - f. Section line
   - g. Break lines
   - h. Leader

4.
   - a.
     - 1) d
     - 2) c
     - 3) f
     - 4) a
     - 5) g
     - 6) b
     - 7) e
   - b.
     - 1) c
     - 2) a
     - 3) b

5. a. 2 7/16"
   b. 3 9/16"
   c. 1 3/8"
   d. 4 3/4"
   e. 2 1/2"
   f. 5 3/4"
   g. 6 1/2"
   h. 4"
6. a. Sizes
   b. Types and quality of building materials
   c. Concrete finishes
   d. Method of construction
   e. Slump of concrete
   f. Concrete test
   g. Types of concrete
   h. Tolerances
7. Performance skills evaluated to the satisfaction of the instructor

ESTIMATING
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to read the concrete calculator. He should be able to calculate the required amounts of concrete by using the calculator, formula, and estimating table. He should be able to calculate linear feet of lumber and wire mesh. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match the terms associated with estimating to the correct definitions.
2. Arrange in order the steps to follow when reading the concrete calculator.
3. Name the steps to follow when reading the concrete estimating table.
4. State the formula for estimating the amount of concrete needed for a given pour.
5. List the steps in the procedure for estimating the amount of wire mesh needed for a given pour.
6. List the standard sizes of wire mesh.
7. State the size of a roll of wire mesh and the number of square feet in a roll.
8. Read the concrete calculator.
9. Calculate the amount of concrete needed for a given pour by using the concrete formula, estimating table, and calculator.
10. Estimate the number of linear feet of two by fours and stakes needed for a pour.
11. Calculate the number of linear feet and square feet of welded wire mesh needed for a pour.

ESTIMATING
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide each student with objective sheet.

   B. Provide each student with information and assignment sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Provide students with concrete calculators.

   G. Demonstrate each method of estimating.

   H. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete assignment sheets.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Concrete Calculator

      2. TM 2--Concrete Estimating Table

      3. TM 3--Standard Sizes of Welded Wire Mesh

D. Assignment sheets

1. Assignment Sheet #1--Read the Concrete Calculator
2. Assignment Sheet #2--Apply the Concrete Formula
3. Assignment Sheet #3--Use the Concrete Calculator
4. Assignment Sheet #4--Read the Concrete Estimating Table
5. Assignment Sheet #5--Estimate the Amount of Material for a Job
6. Assignment Sheet #6--Calculate the Amount of Wire Mesh for a Job

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. *Concrete Technology.* Skokie, Illinois: Portland Cement Association, 1965.

B. *The Specialty House.* Lance Construction Supplies, Inc., 4225 West Ogden Avenue, Chicago, Illinois.

ESTIMATING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Estimating--Determining the amount of substance or materials needed

B. Calculate--Mathematical process of solving problems

C. Formula--Group of symbols illustrated to express a single concept

D. Linear foot--Unit of measurement in a straight line

E. Tolerance (+ or -)--Range of variation permitted in maintaining a specified dimension

F. Cubic yard--Unit of measurement used when ordering concrete

Example: 3' x 3' x 3' = 27 cubic feet = 1 cubic yard

II. Steps to follow when reading the concrete calculator (Transparency 1)

A. Select desired thickness on scale A

B. Select desired width or height on scale B

C. Align scale A with scale B

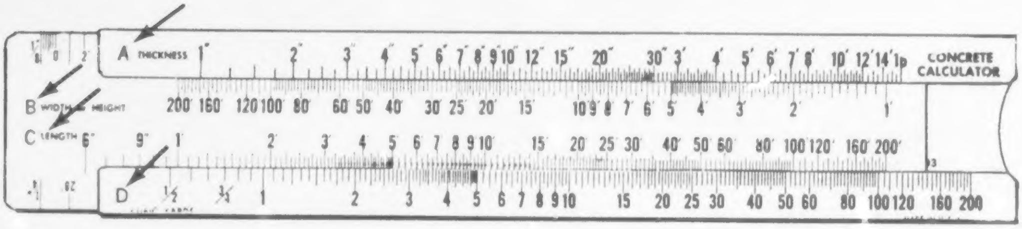
D. Select desired length on scale C

E. Find the amount of concrete indicated on scale D where it aligns with scale C

(NOTE: Figure concrete to nearest one quarter yard.)

F. Example

1. Slab dimensions: 4" thick, 42 1/2' wide, and 40' long


A THICKNESS
1" 2" 3" 4" 5" 6" 7" 8" 9 10" 12" 15" 20" 30" 3' 4' 5' 6' 7' 8' 10' 12' 14' 1p
CONCRETE CALCULATOR
B WIDTH & HEIGHT
200' 160' 120 100' 80' 60' 50' 40' 30' 25' 20' 15' 10 9' 8' 7' 6' 5' 4' 3' 2' 1'
C LENGTH
6" 9" 1' 2' 3' 4' 5' 6' 7' 8' 9 10' 15' 20' 25' 30' 40' 50' 60' 80' 100' 120' 160' 200'
D
1/2 3/4 1 2 3 4 5 6 7 8 9 10 15 20 25 30 40 50 60 80 100 120 160 200

2. Locate 42 1/2 feet on scale B and align with 4 inches on scale A

3. Locate 40 feet on scale C and read figure on scale D that is aligned with scale C

4. Answer is 21 1/2 cubic yards

INFORMATION SHEET

III. Steps to follow when reading concrete estimating table (Transparency 2)

   A. Locate desired thickness in column A

   B. Read across from desired thickness in column A and identify square feet in column B

   C. Calculate the square feet for job

   D. Divide square feet of job by square feet in column B

   E. Example

   Job to be poured is four (4) inches thick, forty (40) feet wide, and eighty (80) feet long

   1. 4 inches on table = 81 square feet

   2. Square feet of job 40' x 80' = 3200 square feet

   3. 3200 square feet ÷ 81 square feet = 39.5 cubic yards

IV. Formula for estimating amount of concrete

$$\frac{\text{Width in feet x length in feet x thickness in feet}}{27} = \text{cubic yards of concrete}$$

(NOTE: Thickness quite often being in inches, this has to be broken down by using fractions or decimals.)

Example using a fraction:

$$\frac{30' \times 60' \times 4''}{27} = \frac{30' \times 60' \times 4/12' \text{ or } 1/3'}{27} = 22.22 \text{ cubic yards}$$

Example using a decimal:

$$\frac{30' \times 60' \times .33'}{27} = \frac{594}{27} = 22 \text{ cubic yards}$$

V. Procedure for estimating amount of wire mesh

   A. Calculate linear feet

   B. Overlap each row six inches

INFORMATION SHEET

VI. Standard sizes of wire mesh (Transparency 3)

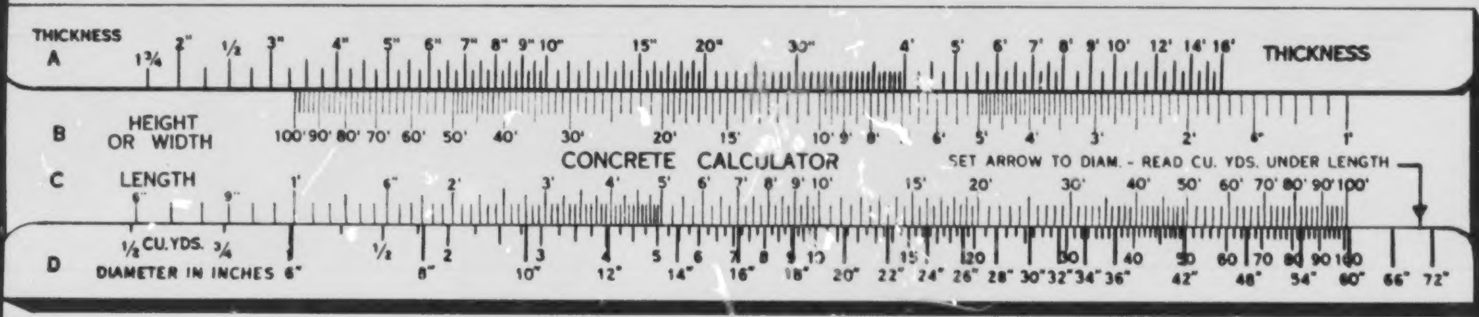
- A. 6" x 6" mesh size--#6/#6 wire size
- B. 6" x 6" mesh size--#8/#8 wire size
- C. 6" x 6" mesh size--#10/#10 wire size
- D. 4" x 4" mesh size--#12/#12 wire size

(NOTE: Mesh is usually referred to as "six-six-ten-ten" or 6-6-1.4/1.4.)

VII. Mesh roll size and square footage

- A. 5' x 150'
- B. 750 square feet per roll

Concrete Calculator

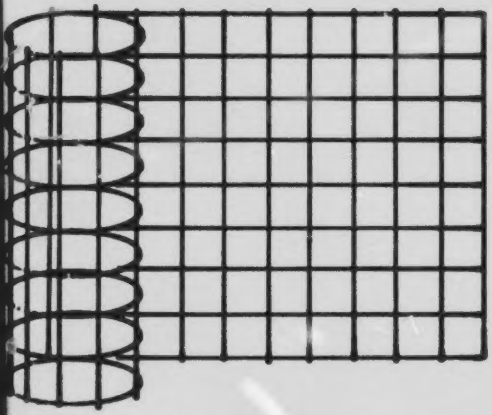

THICKNESS
A
1¾ 2" ½ 3" 4" 5" 6" 7" 8" 9" 10" 15" 20" 30" 4' 5' 6' 7' 8' 9' 10' 12' 14' 16'
THICKNESS
B
HEIGHT OR WIDTH
100' 90' 80' 70' 60' 50' 40' 30' 20' 15' 10' 9' 8' 6' 5' 4' 3' 2' 6" 1"
CONCRETE CALCULATOR
SET ARROW TO DIAM. - READ CU. YDS. UNDER LENGTH
C
LENGTH
6" 9" 1' 6" 2' 3' 4' 5' 6' 7' 8' 9' 10' 15' 20' 30' 40' 50' 60' 70' 80' 90' 100'
D
½ CU. YDS. ¾ 1 ½ 2 3 4 5 6 7 8 9 10 15 20 30 40 50 60 70 80 90 100
DIAMETER IN INCHES 6" 8" 10" 12" 14" 16" 18" 20" 22" 24" 26" 28" 30" 32" 34" 36" 42" 48" 54" 60" 66" 72"

956

Concrete Estimating Table

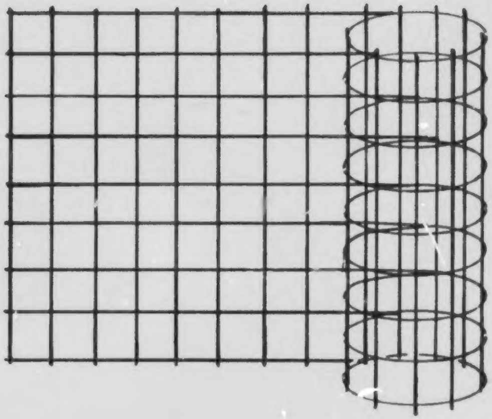
A Depth, in.	B Sq. ft.
1	324
1–1/4	259
1–1/2	216
1–3/4	185
2	162
2–1/4	144
2–1/2	130
2–3/4	118
3	108
3–1/4	100
3–1/2	93
3–3/4	86
4	81
4–1/4	76
4–1/2	72
4–3/4	68
5	65
5–1/4	62
5–1/2	59
5–3/4	56
6	54
6–1/4	52
6–1/2	50
6–3/4	48
7	46
7–1/4	45
7–1/2	43
7–3/4	42
8	40
8–1/4	39
8–1/2	38
8–3/4	37
9	36
9–1/4	35
9–1/2	34
9–3/4	33
10	32.5
10–1/4	31.5
10–1/2	31
10–3/4	30
11	29.5
11–1/4	29
11–1/2	28
11–3/4	27.5
12	27

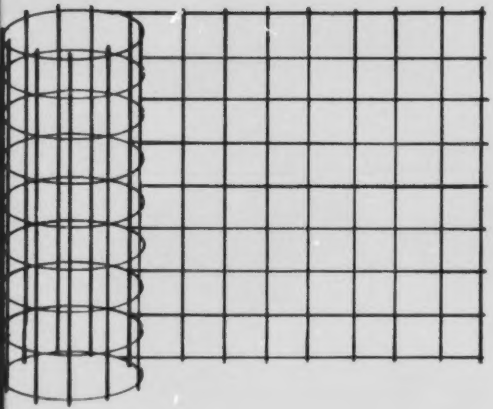
Standard Sizes of Welded Wire Mesh



6x6 - 6x6

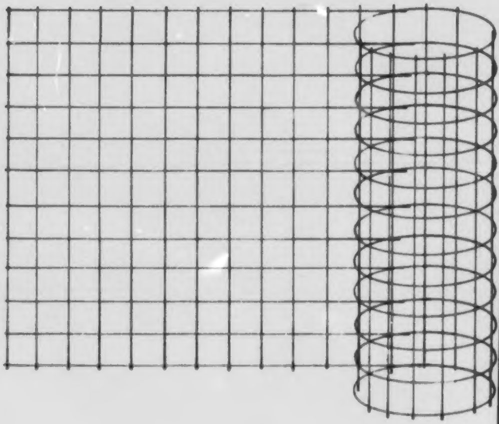
6x6 - 8x8





6x6 - 10x10

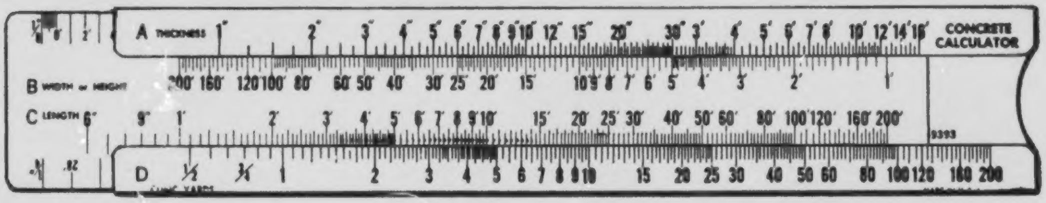
4x4 - 12x12



ESTIMATING
UNIT II

ASSIGNMENT SHEET #1--READ THE CONCRETE CALCULATOR

Using the calculator below, find the answers to the following problems.


A THICKNESS 1" 2" 3" 4" 5" 6" 7" 8" 9" 10" 12" 15" 20" 30" 3' 4' 5' 6' 7' 8' 10' 12' 14' 16'
CONCRETE CALCULATOR
B WIDTH or HEIGHT 200' 160' 120' 100' 80' 60' 50' 40' 30' 25' 20' 15' 10' 9' 8' 7' 6' 5' 4' 3' 2' 1'
C LENGTH 6" 9" 1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 15' 20' 25' 30' 40' 50' 60' 80' 100' 120' 160' 200'
9393
D ½ ¾ 1 2 3 4 5 6 7 8 9 10 15 20 25 30 40 50 60 80 100 120 160 200
CUBIC YARDS

1. Find the thickness: ______________________

   a. Width--30 feet

   b. Length--6 feet 6 inches

   c. Cubic yards--3

2. Find the cubic yards: ______________________

   a. Thickness--2 1/2 inches

   b. Width--60 feet

   c. Length--50 feet

ASSIGNMENT SHEET #1

3. Find the length. ____________________

   a. Thickness--15 inches

   b. Width--10 feet

   c. Cubic yards--7

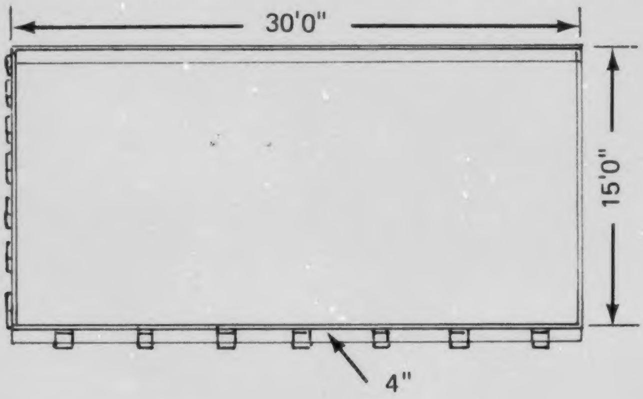
959-A

ESTIMATING
UNIT II

ASSIGNMENT SHEET #2--APPLY THE CONCRETE FORMULA

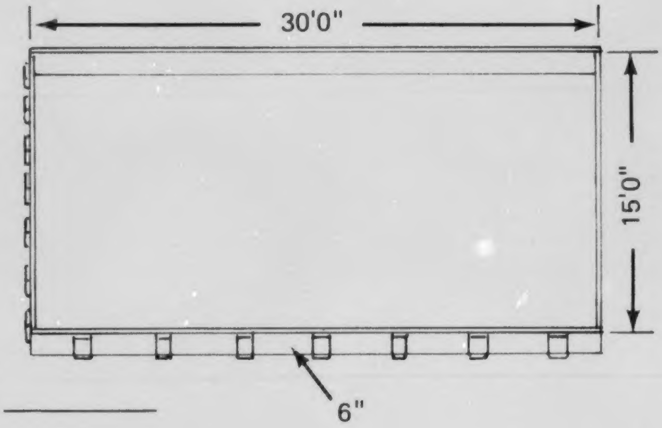
Using the concrete formula, calculate the amount of concrete for each job.

1.



Amount of concrete ____________

2.



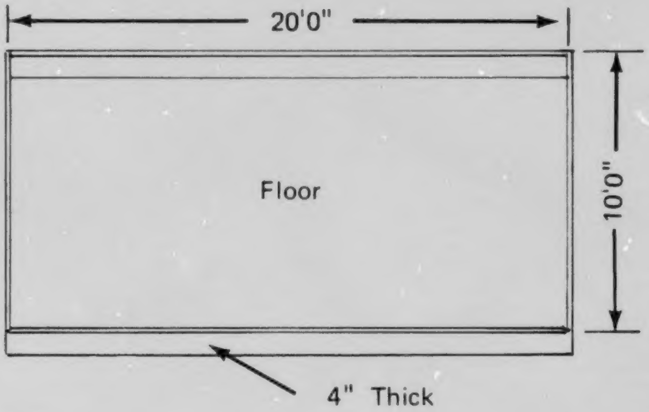
Amount of concrete ____________

ESTIMATING
UNIT II

ASSIGNMENT SHEET #3--USE THE CONCRETE CALCULATOR

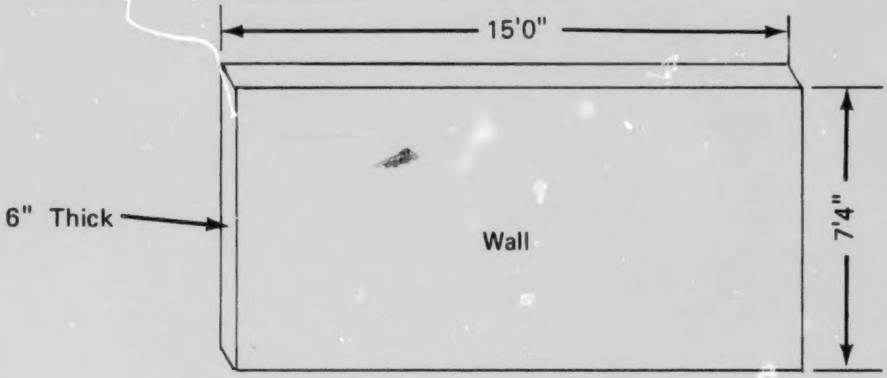
Using the concrete calculator, determine the amount of concrete for the following jobs.

1.


20'0"
Floor
10'0"
4" Thick

Amount of concrete ________

2.


15'0"
6" Thick
Wall
7'4"

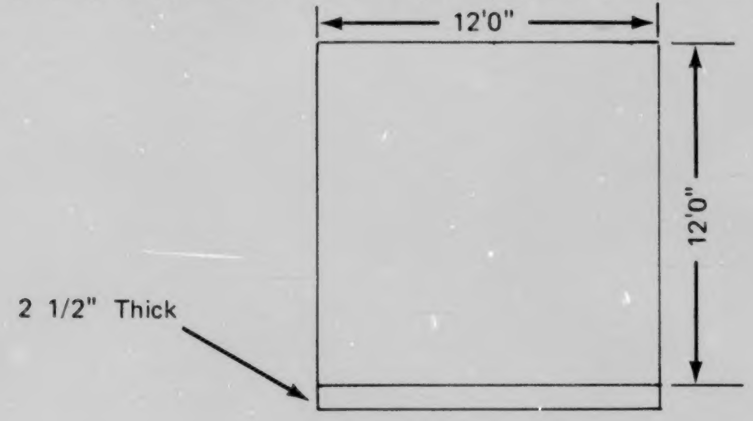
Amount of concrete ________

ESTIMATING
UNIT II

ASSIGNMENT SHEET #4--READ THE CONCRETE ESTIMATING TABLE

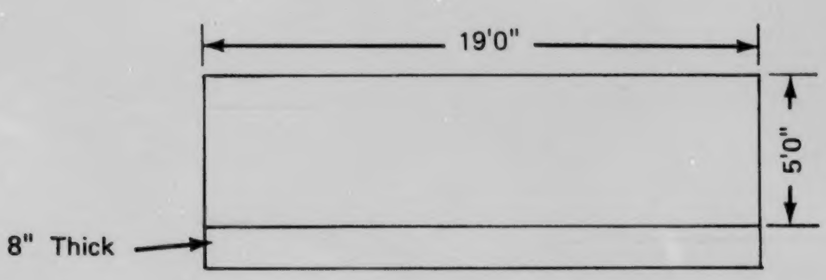
Using the estimating table, calculate the amount of concrete for the following jobs.

1.


12'0"
12'0"
2 1/2" Thick

Amount of concrete __________

2.


19'0"
5'0"
8" Thick

Amount of concrete __________

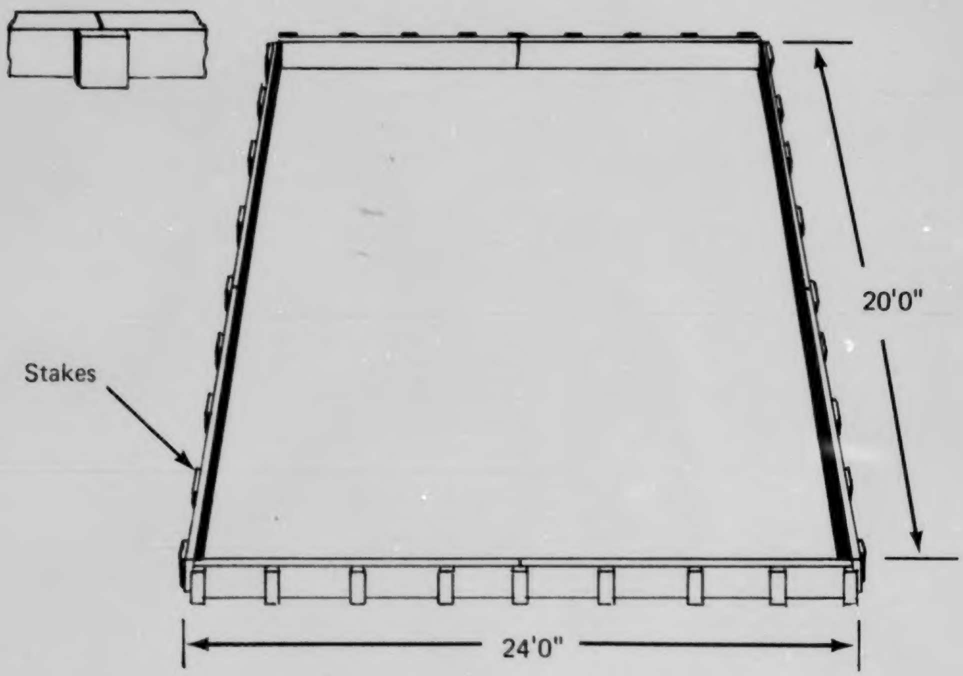
ESTIMATING
UNIT II

ASSIGNMENT SHEET #5--ESTIMATE THE AMOUNT OF MATERIAL FOR A JOB

Estimate the number of linear feet of two by fours and stakes needed for the following job.

(NOTE: Remember that lumber is purchased in even sizes, such as 6'-8'-10'-12'. Also remember that stakes are set approximately three feet apart. There must be a stake at each end of each board or a stake to split the boards.)

Example



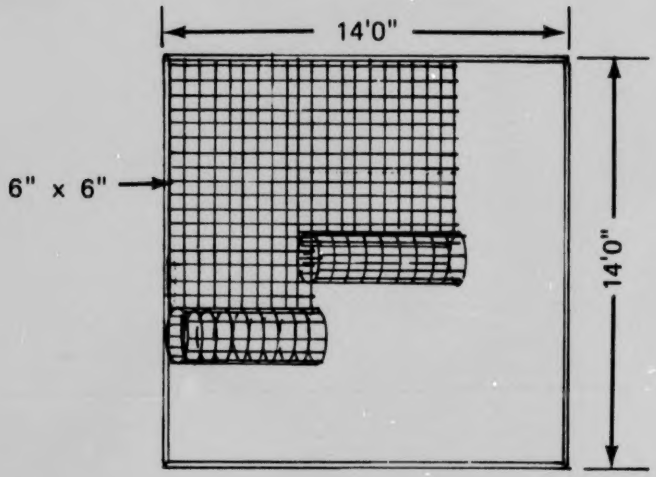
1. Linear feet of two by fours __________
2. Number of stakes __________

ESTIMATING
UNIT II

ASSIGNMENT SHEET #6--CALCULATE THE AMOUNT OF WIRE MESH FOR A JOB

Calculate the amount of wire mesh for the following job. State both the linear feet and square feet.

(NOTE: There must be a six inch lap for each roll.)



1. Linear feet ___________

2. Square feet ___________

ESTIMATING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 5"
2. 23 1/2 cubic yards
3. 15'

Assignment Sheet #2

1. 5.55 cubic yards
2. 8.33 cubic yards

Assignment Sheet #3

1. 2 1/2 cubic yards
2. 2 cubic yards

Assignment Sheet #4

1. 1.10 cubic yards
2. 2.37 cubic yards

Assignment Sheet #5

1. 88 linear feet
2. 36 stakes

Assignment Sheet #6

1. 42 linear feet
2. 210 square feet

ESTIMATING
UNIT II

TEST

1. Match the terms on the right to the correct definitions.

_____a. Unit of measurement in a straight line

_____b. Determining the amount of substance or materials needed

_____c. Range of variation permitted in maintaining a specified dimension

_____d. Unit of measurement used when ordering concrete

_____e. Mathematical process of solving problems

_____f. Group of symbols illustrated to express a single concept

1. Cubic yard
2. Estimating
3. Linear foot
4. Calculate
5. Tolerance (+ or -)
6. Formula

2. Arrange in order the steps to follow when reading the concrete calculator. Place the appropriate numbers in the blanks, starting with number 1.

_____a. Select desired length on scale C

_____b. Select desired thickness on scale A

_____c. Select desired width or height on scale B

_____d. Align scale A with scale B

_____e. Find the amount of concrete indicated on scale D where it aligns with scale C

3. Name the steps to follow when reading the concrete estimating table.

a.

b.

c.

d.

4. State the formula for estimating the amount of concrete needed for a given pour.

5. List the steps in the procedure for estimating the amount of wire mesh needed for a given pour.

   a.

   b.

6. List the four standard sizes of wire mesh.

   a.

   b.

   c.

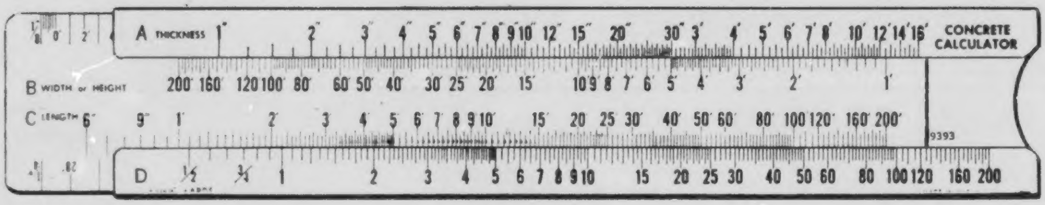
   d.

7. State the size of a roll of wire mesh and the number of square feet in a roll.

   a. Width and length ___________

   b. Square feet in roll ___________

8. Read the concrete calculator illustrated below and determine the length of the slab. The slab to be poured is 5 inches thick, 30 feet wide, and will take 3 cubic yards of concrete.


A THICKNESS 1" 2" 3" 4" 5" 6" 7" 8" 9" 10" 12" 15" 20" 30" 3' 4' 5' 6' 7' 8' 10' 12' 14' 16'
CONCRETE CALCULATOR
B WIDTH or HEIGHT 200' 160' 120' 100' 80' 60' 50' 40' 30' 25' 20' 15' 10' 9' 8' 7' 6' 5' 4' 3' 2' 1'
C LENGTH 6" 9" 1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 15' 20' 25' 30' 40' 50' 60' 80' 100' 120' 160' 200'
9393
D ½ ¾ 1 2 3 4 5 6 7 8 9 10 15 20 25 30 40 50 60 80 100 120 160 200

____

9. Calculate the amount of concrete needed for the following pour.

The slab to be poured is 5 inches thick, 15 feet wide, and 20 feet long. Figure this problem using the three methods.

a. Concrete calculator

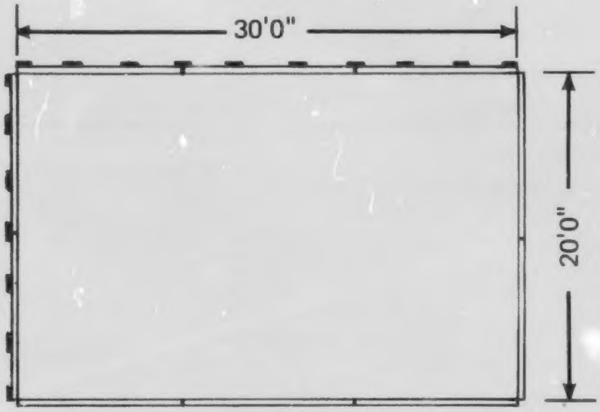
b. Concrete formula

c. Concrete estimating table

One Cubic Yard of Concrete Will Place:					
Thickness	Sq. Ft.	Thickness	Sq. Ft.	Thickness	Sq. Ft.
1"	324	5"	65	9"	36
1 1/4"	259	5 1/4"	62	9 1/4"	35
1 1/2"	216	5 1/2"	59	9 1/2"	34
1 3/4"	185	5 3/4"	56	9 3/4"	33
2"	162	6"	54	10"	32.5
2 1/4"	144	6 1/4"	52	10 1/4"	31.5
2 1/2"	130	6 1/2"	50	10 1/2"	31
2 3/4"	118	6 3/4"	48	10 3/4"	30
3"	108	7"	46	11"	29.5
3 1/4"	100	7 1/4"	45	11 1/4"	29
3 1/2"	93	7 1/2"	43	11 1/2"	28
3 3/4"	86	7 3/4"	42	11 3/4"	27.5
4"	81	8"	40	12"	27
4 1/4"	76	8 1/4"	39	15"	21.5
4 1/2"	72	8 1/2"	38	18"	18
4 3/4"	68	8 3/4"	37	24"	13.5

10. Estimate the number of linear feet of two by fours and stakes needed for the following pour.

The job to be poured is 20' x 30' x 4". Remember that stakes are set approximately 3 feet apart.



11. Calculate the number of linear feet and square feet of welded mesh wire needed for the following pour.

The job to be poured is 25 feet wide, 40 feet long, and 4 inches thick.

ESTIMATING
UNIT II

ANSWERS TO TEST

1. a. 3
   b. 2
   c. 5
   d. 1
   e. 4
   f. 6

2. a. 4
   b. 1
   c. 2
   d. 3
   e. 5

3. a. Locate desired thickness in column A
   b. Read across from desired thickness in column A and identify square feet in column B
   c. Calculate the square feet for job
   d. Divide square feet of job by square feet in column B

4. $$\frac{\text{Width in feet} \times \text{length in feet} \times \text{thickness in feet}}{27}$$

5. a. Calculate linear feet
   b. Overlap each row six inches

6. a. 6" x 6"--#6/#6
   b. 6" x 6"--#8/#8
   c. 6" x 6"--#10/#10
   d. 4" x 4"--#12/#12

7. a. 5' x 150'

   b. 750 square feet

8. 6'6" long

9. a. 4 3/4 cubic yards

   b. 4.62 cubic yards

   c. 4.61 cubic yards

10. 100 linear feet

    34 stakes

11. 222 1/2 linear feet

    1100 square feet

CEMENT MASON'S
PROGRESS CHART

Section H
Blueprint Reading and Estimating

Job	UNIT I Blueprint Reading			UNIT II Estimating																
	1	2	3	1	2	3														
Student's Name	UNIT TEST			UNIT TEST																
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy	85% Correct			85% Correct																
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

PATCHING
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to arrange in order steps to take before patching floor holes and form tie holes. He should be able to select proper materials to use in patching and to name steps to follow when matching patch material to original concrete. He should be able to demonstrate the ability to patch a deep hole in a wall area and repair holes in finished floor area. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with patching to the correct definitions.
2. Name three reasons for patching.
3. Select from a list the most important factor to consider before applying a patch.
4. Arrange in order the steps to take before patching a hole in a floor area.
5. Arrange in order steps to take before patching form tie holes.
6. Name materials used to bond concrete.
7. Select the proper material to use when patching a deep hole in a wall area.
8. Name steps to follow when matching patch material to original concrete.
9. Demonstrate the ability to:
   a. Patch deep hole in wall.
   b. Patch hole in wall where water pressure exists.
   c. Repair hole in finished floor.

PATCHING
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss terminal and specific objectives.

   E. Discuss information sheet.

   F. Contact material company for information when choosing hydraulic and/or fast-setting cements.

   G. Demonstrate and discuss procedures outlined in job sheets.

   H. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Form Ties

      2. TM 2--Form Ties (Continued)

D. Job sheets

  1. Job Sheet #1--Patch Deep Hole in Wall
  2. Job Sheet #2--Patch Hole in Wall Where Water Pressure Exists
  3. Job Sheet #3--Repair Hole in Finished Floor

E. Test

F. Answers to test

II. Reference--Riles, Wilson. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1968.

PATCHING
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Patching--Process of filling form tie holes, honeycomb, and other defects in concrete

B. Bonding agent--Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

C. Bond-To cause to adhere firmly

D. Neat cement--Pure cement (without anything added)

E. Mud--Mixture of cement, sand, and water

F. Dry pack--Very stiff mud mixture

G. Hawk--Tool used to hold material at ready when patching and plastering

H. Flush--Even with

I. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete

J. Honeycomb--Cavity or pit in concrete

K. Form tie--Wire or metal crosstie used to hold pressure of wet concrete and to maintain the proper wall thickness

L. Cone insert--Plastic or wood; assures proper setback and acts as positive spreader for forms

M. Carborundum or rubbing stone--Tool used to grind and/or rub concrete

N. Hydraulic cement--Fast-setting cement that is capable of setting and hardening underwater due to interaction of water and the constituents of cement

O. Fast-setting cement--Commercial type of patching material manufactured by many different companies

II. Reasons for patching

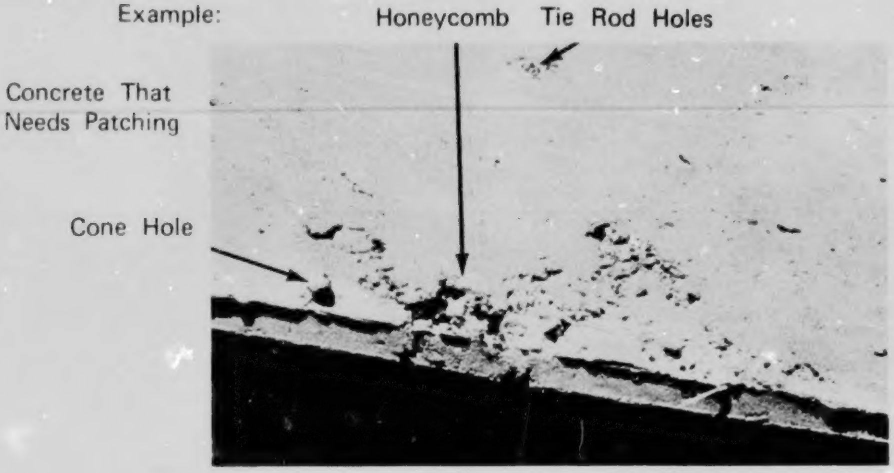
A. Improve appearance of concrete

B. Make old work more serviceable

INFORMATION SHEET

C. Seal walls against moisture

Example:


Honeycomb
Tie Rod Holes
Concrete That Needs Patching
Cone Hole

III. Most important factor when patching--Good bond

IV. Steps to take before patching a hole in floor area

- A. Remove all oil, grease, and stains
- B. Chip area to roughen surface
- C. Clean area to remove chips and dust
- D. Apply bonding agent

V. Steps to take before patching form tie holes (Transparencies 1 and 2)

- A. Break form ties
- B. Remove cone inserts
- C. Remove all oil and grease
- D. Apply bonding agent

VI. Materials used to bond concrete

- A. Water and neat cement
- B. Commercial type bonding agent

INFORMATION SHEET

VII. Patching material for deep holes--Dry pack

(NOTE: This mixture should be mixed very dry. Patching material will vary in design according to the job to be patched. Designs will vary from 1:1 mix to 1:4 mix, depending on size of aggregate used. Aggregate could vary in size from a very fine sand to a coarse gravel. There are also various brands of commercial type patching materials.)

VIII. Steps to follow when matching patch material to original concrete

A. Use neat cement for bonding agent

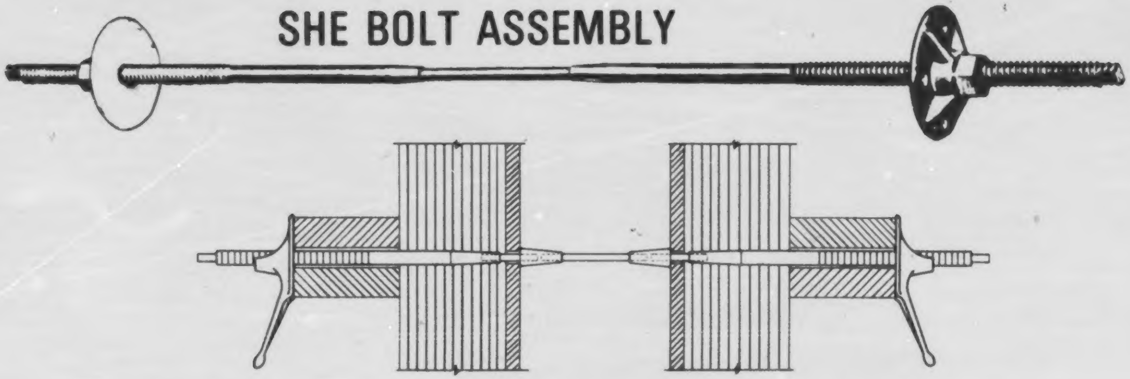
B. Try to use same materials as used in original mix

C. Blend colors

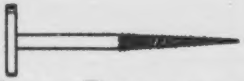
D. Make samples

(NOTE: When patching, be sure to match original concrete, especially when patching colored concrete. Quite often commercial bonds will not work because they bleed through and cause distortion to take place.)

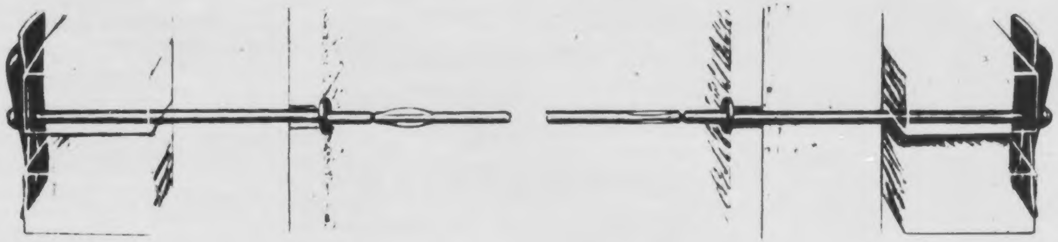
Form Ties

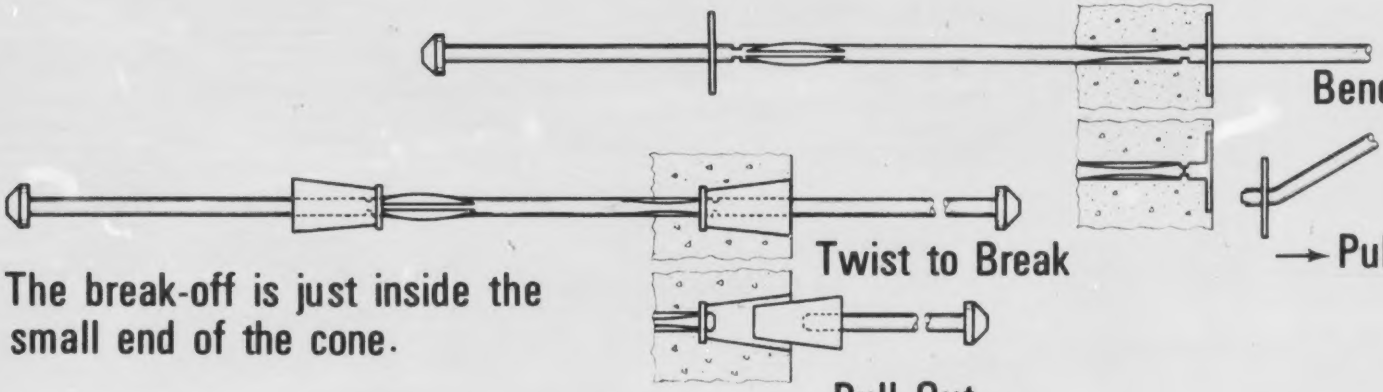


The Nut Washer Assembly consists of Two Outside Rods and Two Nut Washers



Cone Remover





Bend Over End and Twist to Break

→ Pull Out

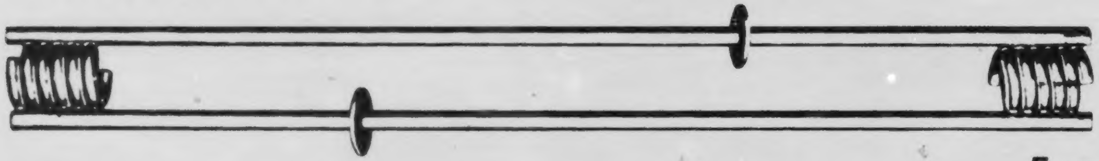
Twist to Break

The break-off is just inside the small end of the cone.

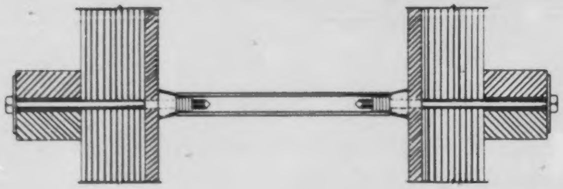
→ Pull Out

Form Ties
(Continued)

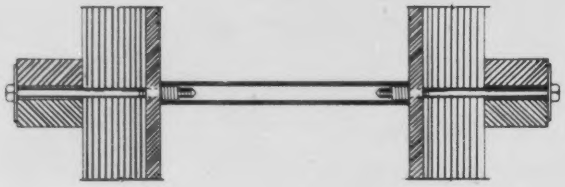
WATERSEAL COIL TIE



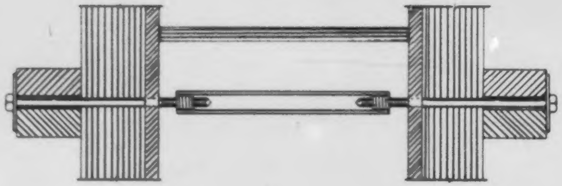
COIL TIE with SPREADER CONE



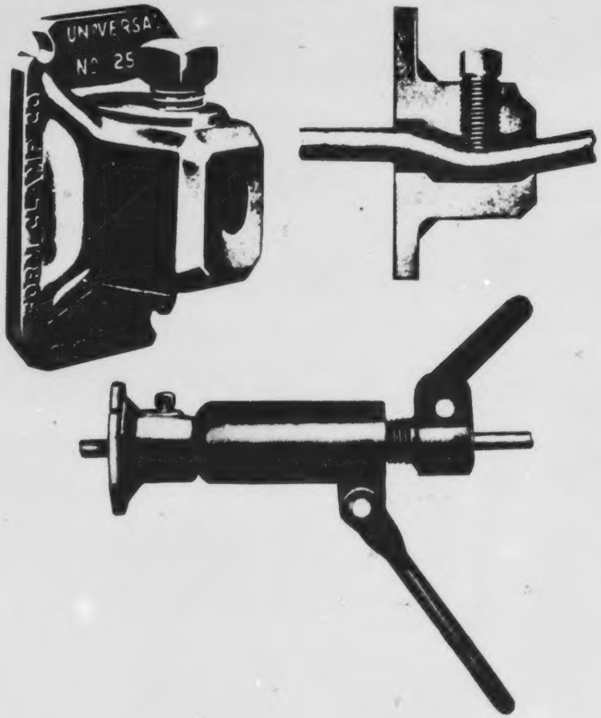
COIL TIE as SPREADER and TIE



COIL TIE with SEPARATE SPREADER



Form Clamps (Buttons)
Used with Plain Round
Mild Steel Rods



PATCHING
UNIT I

JOB SHEET #1--PATCH DEEP HOLE IN WALL

I. Tools and materials

   A. Tools

      1. Chipping hammer
      2. Block of wood
      3. Margin trowel
      4. Cork float
      5. Brush
      6. Goggles
      7. Respirator

   B. Materials

      1. Bucket of dry pack
      2. Bucket of water
      3. Bonding agent
      4. Curing agent

II. Procedure:

   A. Chip out any loose aggregate

   B. Brush area clean of chips and dust

   C. Dampen area with brush

   D. Paint area with bonding agent

   (NOTE: When using commercial type bonding agents, manufacturer's specifications should be followed.)

   E. Fill with dry pack, using margin trowel and cork float as a hawk

JOB SHEET #1

F. Apply dry pack to hole

G. Use hammer and block of wood to tamp the material tightly

H. Continue applying dry pack and tamping until hole is filled flush with surface

I. Use brush to lightly dampen surface of patch

J. Use cork float to float out patch until it is smooth and resembles original concrete

(NOTE: Depending on finish of original concrete, patch may have to be finished with trowel, other type float, or even by placing a piece of wood against surface and tapping lightly to achieve a wood grain texture.)

K. Apply curing agent as soon as patch is hard enough

L. Use margin trowel, brush, and water to clean tools and equipment

PATCHING
UNIT I

JOB SHEET #2--PATCH HOLE IN WALL WHERE WATER PRESSURE EXISTS

I. Tools and materials

   A. Tools

      1. Chipping hammer
      2. Block of wood
      3. Margin trowel
      4. Cork float
      5. Brush
      6. Goggles
      7. Respirator

   B. Materials

      1. Bucket of water
      2. Bonding agent
      3. Commercial type of fast-setting cement
      4. Mud
      5. Curing agent
      6. Piece of pipe

II. Procedure

   A. Chip out any loose aggregate

   B. Brush area clean of chips and dust

   C. Dampen area with brush

   D. Paint area with bonding agent

   (NOTE: When using commercial type bonding agents, manufacturer's specifications should be followed.)

JOB SHEET #2

E. Insert a piece of one-half inch or three-quarter inch pipe in hole so that water will run through pipe

(NOTE: Pipe should be cut so that it will be recessed about one-half inch behind face of wall.)

F. Hold pipe in place and make first application of fast-setting cement

(NOTE: There are many types of commercial fast-setting cements.)

G. Use block of wood to tamp material tightly into hole and around pipe

H. Continue applying material and tamping until hole is filled to about one-half to three-eighths inch from face of wall

(NOTE: This last half inch or three-eighths inch should be filled with a mud that is similar to original concrete so that it will blend with the original concrete.)

I. Hold some of the fast-setting cement in hand until it begins to set; press it tightly into end of pipe and hold firmly until it sets hard

(NOTE: Sometimes a longer pipe is used. After the hole has been patched around pipe, the pipe can be removed and the hole plugged.)

J. Use premixed mud and apply over entire patch

K. Use cork float and work out patch to resemble original concrete

L. Apply curing agent as soon as patch is hard enough

(NOTE: Be sure to use curing agent that is specified.)

M. Use margin trowel, brush, and water to clean tools and equipment

PATCHING
UNIT I

JOB SHEET #3--REPAIR HOLE IN FINISHED FLOOR

I. Tools and materials

   A. Tools

      1. Chipping hammer or hammer and chisel

      2. Stiff broom or brush

      3. Fine-haired brush

      4. Straightedge

      5. Hand float

      6. Finishing trowel

      7. Rubbing stone

      8. Sprayer

   B. Materials

      1. Bonding agent

      2. Concrete

      3. Bucket of water

      4. Curing agent

II. Procedure

   A. Dampen area with brush and water

   B. Paint area to be patched with bonding agent

   (NOTE: Follow manufacturer's recommendations.)

JOB SHEET #3

C. Place concrete on area to be patched

D. Use rubbing stone and work concrete into floor to assure a good bond

E. Use straightedge in a sawlike motion to rod off concrete

F. Use float to smooth off surface of patch

(NOTE: A time period will probably need to elapse before continuing.)

G. Allow concrete to harden sufficiently

H. Refloat area using a semicircular motion

(CAUTION: Be sure patch is level with area around it and edges have been filled sufficiently.)

I. Continue floating until entire patch has been done

J. Trowel patch with finishing trowel, using it in a semicircular motion

K. Allow concrete to harden enough so that desired finish can be obtained

L. Retrowel patch using same method as used previously

M. Apply curing agent as soon as concrete is hard enough

N. Use margin trowel, brush, and water to clean tools and equipment

PATCHING
UNIT I

TEST

1. Match terms on the right to the proper definitions by placing the appropriate numbers in the blanks provided.

_____a. Process of filling form tie holes, honeycomb, and other defects in concrete

_____b. Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

_____c. To cause to adhere firmly

_____d. Pure cement (without anything added)

_____e. Mixture of cement, sand, and water

_____f. Very stiff mud mixture

_____g. Tool used to hold material at ready when patching and plastering

_____h. Even with

_____i. Chemical compound used to prevent evaporation of moisture from concrete

_____j. Cavity or pit in concrete

_____k. Wire or metal crosstie used to hold pressure of wet concrete and to maintain the proper wall thickness

_____l. Plastic or wood; assures proper setback and acts as positive spreader for forms

_____m. Tool used to grind and/or rub concrete

_____n. Fast-setting cement that is capable of setting and hardening underwater due to interaction of water and the constituents of cement

_____o. Commercial type of patching material manufactured by many different companies

1. Neat cement
2. Mud
3. Patching
4. Dry pack
5. Curing agent
6. Honeycomb
7. Flush
8. Hawk
9. Bonding agent
10. Bond
11. Form tie
12. Cone insert
13. Hydraulic cement
14. Carborundum or rubbing stone
15. Fast-setting cement

2. Name three reasons for patching.

   a.

   b.

   c.

3. Select from the list below the most important factor to consider before applying a patch. Place an "X" in the proper blank.

   _____a. Consistency of mud

   _____b. Good bond

   _____c. Matching old concrete

   _____d. Clean area

4. Arrange in order the steps to take before patching a hole in a floor area. Number the steps below by placing a "1" before the first step, a "2" before the second, and so on.

   _____a. Clean area to remove chips and dust

   _____b. Apply bonding agent

   _____c. Chip area to roughen surface

   _____d. Remove all oil, grease, and stains

5. Arrange in order the steps to take before patching form tie holes. Number the steps below by placing a "1" before the first step, a "2" before the second, and so on.

   _____a. Remove cone inserts

   _____b. Break form ties

   _____c. Remove all oil and grease

   _____d. Apply bonding agent

6. Name two materials used to bond concrete.

   a.

   b.

7. Select from the list below the proper material to use when patching a deep hole in a wall. Place an "X" in correct blank.

   ______a. Very wet mud

   ______b. Neat cement

   ______c. Dry pack

   ______d. Bonding agent

8. Name steps to follow when matching patch material to original concrete.

   a.

   b.

   c.

   d.

9. Demonstrate the ability to:

   a. Patch deep hole in wall.

   b. Patch hole in wall where water pressure exists.

   c. Repair hole in finished floor.

   (NOTE: If these activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

PATCHING
UNIT I

ANSWERS TO TEST

1.
   a. 3
   b. 9
   c. 10
   d. 1
   e. 2
   f. 4
   g. 8
   h. 7
   i. 5
   j. 6
   k. 11
   l. 12
   m. 14
   n. 13
   o. 15

2.
   a. Improve appearance of concrete
   b. Make old work more serviceable
   c. Seal walls against moisture

3. b

4.
   a. 3
   b. 4
   c. 2
   d. 1

5.
   a. 2
   b. 1
   c. 3
   d. 4

6.
   a. Water and neat cement
   b. Commercial type bonding agent

7. c

8.
   a. Use neat cement for bonding agent
   b. Try to use same materials as used in original mix
   c. Blend colors
   d. Make samples

9. Performance skills evaluated to the satisfaction of the instructor

GRINDING, RUBBING, AND SACKING
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to discuss the proper time to rub and sack and be able to arrange in order the steps to take when preparing walls for rubbing and/or sacking. He should be able to identify types of grinders used on floors and ceilings and demonstrate the ability to perform rubbing and sacking jobs. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with rubbing and sacking to the correct definitions.
2. Arrange in order the steps to take when preparing wall for rubbing and/or sacking.
3. Select from a list two methods of rubbing.
4. Name reasons for rubbing and/or sacking walls.
5. Discuss in a few words the proper time to rub and sack.
6. Select from a list results of premature grinding.
7. Name reasons for grinding a floor.
8. Identify types of grinders used on floors.
9. Name reasons for grinding a ceiling.
10. Identify types of grinding equipment used on ceilings.
11. Demonstrate the ability to:
    a. Rub a wall.
    b. Sack a wall.
    c. Grind and finish a floor.
    d. Grind a ceiling.

GRINDING, RUBBING, AND SACKING
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in the job sheets.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Methods of Rubbing

    2. TM 2--Types of Floor Grinders

    3. TM 3--Types of Equipment Used to Grind Ceilings

D. Job sheets

  1. Job Sheet #1--Rub a Wall

  2. Job Sheet #2--Sack a Wall

  3. Job Sheet #3--Grind and Finish a Floor

  4. Job Sheet #4--Grind a Ceiling

E. Test

F. Answers to test

II. References:

A. Riles, Wilson. *Course for Cement Masons: Workbook.* Sacramento: California State Department of Education, 1968.

B. *Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1974.

C. *Tool Catalog.* Binghamton, New York: Stow Manufacturing Company, 1966.

D. *Tool Catalog.* Silver Spring, Maryland: Equipment Development Company.

E. Bulletin-K 113. Buffalo, New York: Wiesner-Rapp Co., Inc., Kelly Machine Division.

GRINDING, RUBBING, AND SACKING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Rubbing--Process of rubbing or grinding concrete

B. Wet grinding--Process of grinding with power grinder and water

C. Sacking--Process of finishing a wall

D. Patching--Process of filling form tie holes, honeycomb, and any other defects in concrete

E. Mud--Mixture of sand, cement, and water

F. Honeycomb--Cavity or pit in concrete

G. Bonding agent--Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

H. Form tie--Wire or metal crosstie used to hold pressure of wet concrete and to maintain the proper wall thickness

I. Cone insert--Plastic or wood; assures proper setback and acts as positive spreader for forms

J. Sprayer--Apparatus used to apply a liquid in the form of a spray

K. Curing agent--Chemical compound used to prevent evaporation of moisture from concrete

L. Paste--Composition of cement and water fines worked to the surface of concrete

M. Form mark--Mark and projection formed by knotholes and impressions on forms

N. Fins--Concrete that has oozed out of joints between form boards and has hardened as part of the wall

O. Burlap--Coarse, plain woven fabric usually of jute or hemp

P. Dust--Sand and cement mixture proportioned about half and half

Q. Hand stone--Tool used to rub and grind concrete

R. Hawk--Tool used to hold material at ready when patching and/or plastering

INFORMATION SHEET

II. Steps to take when preparing wall for rubbing and/or sacking

   A. Break off form ties

   B. Chip off heavy fins

   C. Remove cone inserts

   D. Dry-grind wall to remove form marks and fins

   E. Fill form tie and cone insert holes and any honeycomb

III. Methods of rubbing (Transparency 1)

   A. Hand stone

   B. Wet grinding with power grinder

IV. Reasons for rubbing and/or sacking walls

   A. Improve appearance

   B. Seal surface from exposure

   C. Fill voids in preparation for painting or other type of finish

V. Proper time to rub and sack concrete--After forms have been removed and concrete is hard enough to dry-grind without loosening or pulling out aggregates

VI. Results of premature grinding

   A. Too much surface fines taken off

   B. Large aggregate loosened

   C. Large aggregate pulled out

VII. Reasons for grinding a floor

   A. Surface rained on

   B. Surface scaled from freeze

   C. Old floor resurfaced

   D. Grind off high spots

INFORMATION SHEET

VIII. Types of grinders used on floors (Transparency 2)

   A. Trowel machine with grinder attachment

   B. Power float with grinder attachment

   C. Commercial floor grinder

IX. Reasons for grinding a ceiling

   A. Prepare ceiling for rubbing

   B. Prepare ceiling for tile

   C. Prepare ceiling for painting

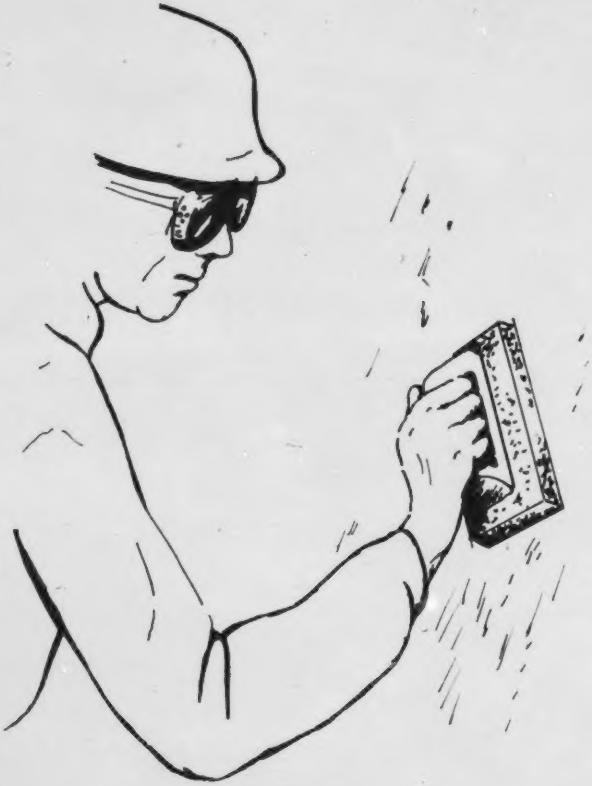
X. Types of grinding equipment used on ceilings (Transparency 3)

   A. Hand grinders--Chipping hammer and hand stone

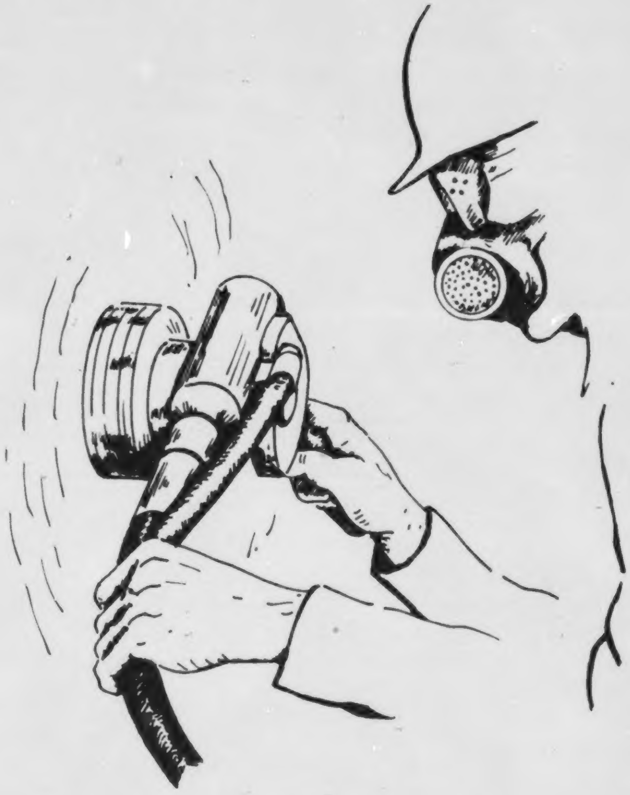
   B. Portable grinder

   C. Ceiling grinder

Methods of Rubbing

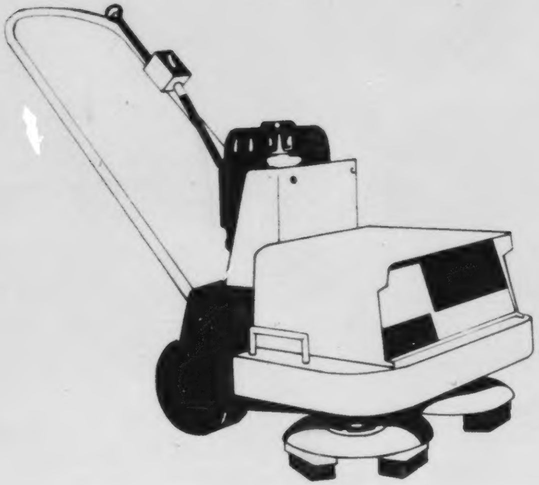


Hand Rub

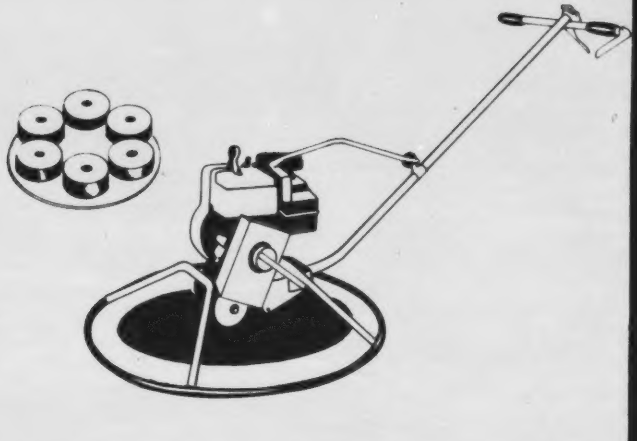


Power Grinder

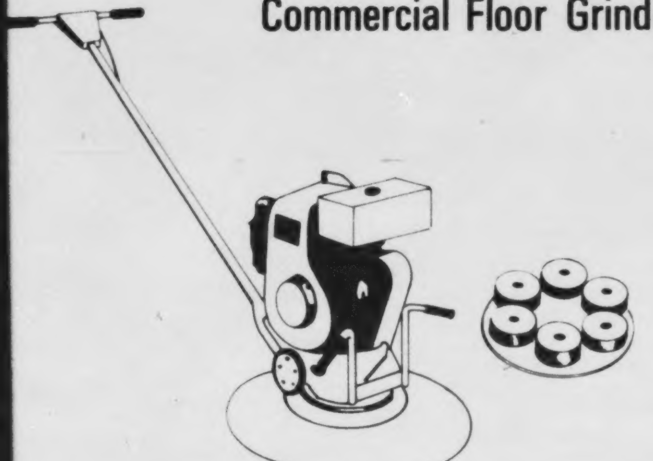
Types of Floor Grinders



Commercial Floor Grinder

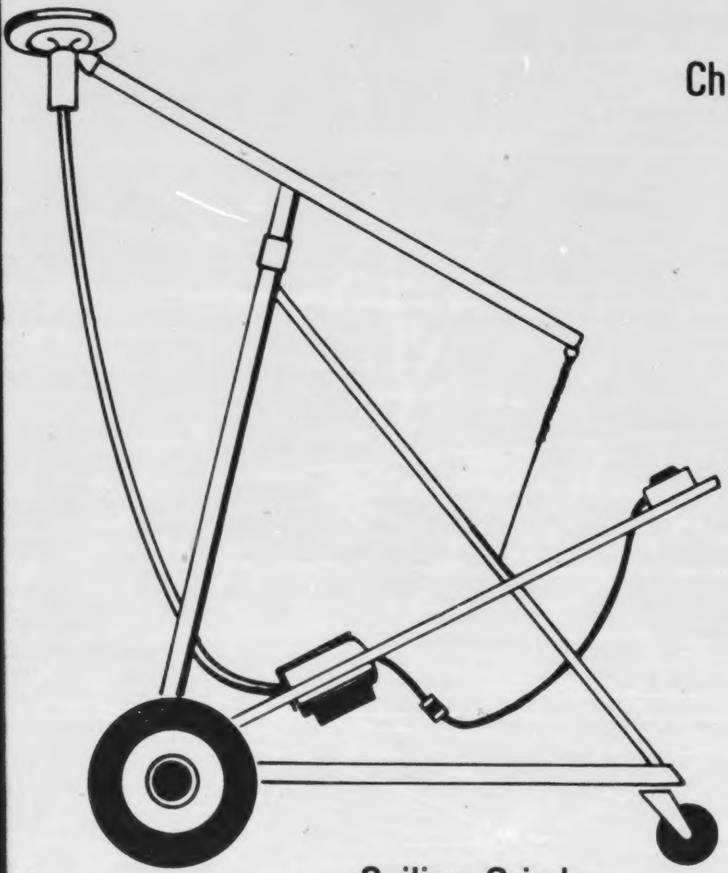


Trowel Machine
with Grinder Attachment



Power Float with Grinder Attachment

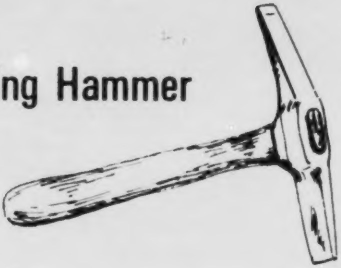
Types of Equipment Used to Grind Ceilings



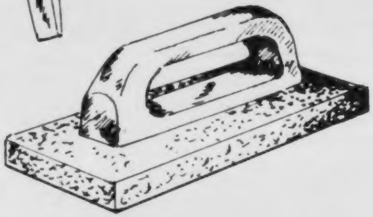
Ceiling Grinder

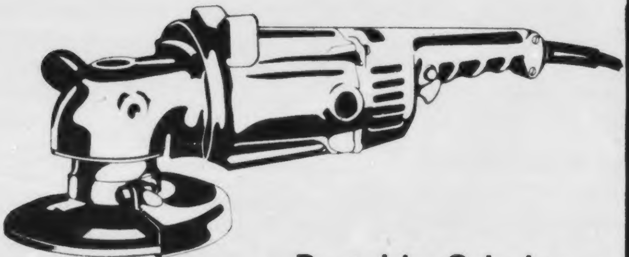
HAND GRINDERS

Chipping Hammer



Hand Stone





Portable Grinder

GRINDING, RUBBING, AND SACKING
UNIT II

JOB SHEET #1--RUB A WALL

I. Tools and materials

  A. Tools

    1. Portable grinder
    2. Chipping hammer
    3. Cork or rubber float
    4. Margin trowel
    5. Brush
    6. Sprayer
    7. Hand stone
    8. Goggles
    9. Respirator
    10. Hard hat

  B. Materials

    1. Mud
    2. Water
    3. Bonding agent
    4. Curing agent
    5. Dust

II. Procedure

  A. Chip off heavy fins and projections

  B. Dry-grind wall, leaving it without projections and form marks

JOB SHEET #1

C. Apply bonding agent to all deep holes and form tie cone holes

D. Use margin trowel and cork float as a hawk to apply very stiff mud to all large holes and form tie cone holes

(NOTE: Mud is applied only if wall is too hard to work up a paste on the surface.)

E. Dampen wall with brush

F. Apply mud with float or brush

(NOTE: Only enough mud is applied to form a paste after rubbing.)

G. Rub wall with power grinder or hand stone until a fine paste is worked up and holes are filled

(NOTE: To avoid wall drying out, grind only about four or five feet before dropping back to finish wall.)

H. Use cork float in a semicircular motion, working all pinholes full of paste and leaving surface with a fine stonelike texture

(NOTE: It may be necessary to sprinkle wall slightly to float out section that has been rubbed.)

I. Rub second section and follow up by floating

J. Continue this procedure until entire wall has been finished

K. Allow wall to dry sufficiently

L. Apply a curing agent, using a sprayer with nozzle adjusted to spray a fine mist

GRINDING, RUBBING, AND SACKING
UNIT II

JOB SHEET #2--SACK A WALL

I. Tools and materials

  A. Tools

    1. Chipping hammer
    2. Portable grinder
    3. Cork or rubber float
    4. Margin trowel
    5. Brush
    6. Burlap
    7. Sprayer
    8. Hand stone
    9. Goggles
    10. Respirator
    11. Hard hat

  B. Materials

    1. Mud
    2. Water
    3. Bonding agent
    4. Curing agent

II. Procedure

  A. Chip off heavy fins and projections

  B. Dry-grind wall leaving it without projections and form marks

  C. Apply bonding agent to all deep holes and form tie cone holes

  D. Use margin trowel and cork float as a hawk to apply very stiff mud and to pack all large holes and form tie cone holes

JOB SHEET #2

E. Dampen surface of wall with brush

F. Apply mud with float and work into all holes and uneven places

G. Place a handful of dust on a piece of burlap and work this over surface

(NOTE: The dust will dry out deep holes and keep them from shrinking.)

H. Use another piece of burlap to wipe all excess mud and dust from the surface of wall

I. Again lightly apply dust to wall

J. Allow wall to dry slightly

K. Wipe all excess dust from wall

(NOTE: Wall will be left with a fine smooth surface.)

L. Let wall dry sufficiently

M. Apply curing agent using sprayer with nozzle adjusted to spray fine mist

N. Use margin trowel, brush, and water to clean tools and equipment

GRINDING, RUBBING, AND SACKING
UNIT II

JOB SHEET #3--GRIND AND FINISH A FLOOR

I. Tools and materials

A. Tools

1. Floor grinder
2. Squeegee
3. Finishing trowel
4. Margin trowel
5. Brush
6. Fine-bristled push broom
7. Sprayer

B. Materials

1. Dust
2. Water
3. Bonding agent
4. Curing agent

II. Procedure

A. Use push broom to clean floor throughly

B. Wet floor with water

C. Start grinder and work it back and forth across floor, backing up width of grinder with each pass

D. Continue this procedure until entire floor has been ground

E. Squeegee floor clean

F. Mix about one pint of bonding agent to five gallons of water or according to manufacturer's specifications

G. Apply this solution to floor

JOB SHEET #3

H. Sprinkle floor with enough dust to form a paste after grinding

(NOTE: Water solution may have to be sprinkled occasionally throughout grinding process.)

I. Start grinder and work across floor from right to left

J. Work back across floor, backing up width of grinder

K. Work back to left again, slightly overlapping first pass

L. Continue this process until entire floor has been ground

M. Move grinder back to starting point, working grinder at right angles to first procedure

N. Continue grinding until entire floor has been ground

O. Hand trowel floor with trowel tilted so that most of the paste is cut off of the floor

(NOTE: Only enough paste should be left on floor to fill holes and voids.)

P. Continue troweling procedures until entire floor is finished

Q. Let floor dry sufficiently

R. Apply curing agent, using a sprayer with nozzle adjusted to spray a fine mist

S. Use margin trowel, brush, and water to clean tools and equipment

GRINDING, RUBBING, AND SACKING
UNIT II

JOB SHEET #4--GRIND A CEILING

I. Tools and materials

   A. Ceiling grinder

   B. Drop cord

   C. Goggles

   D. Respirator

   E. Hard hat

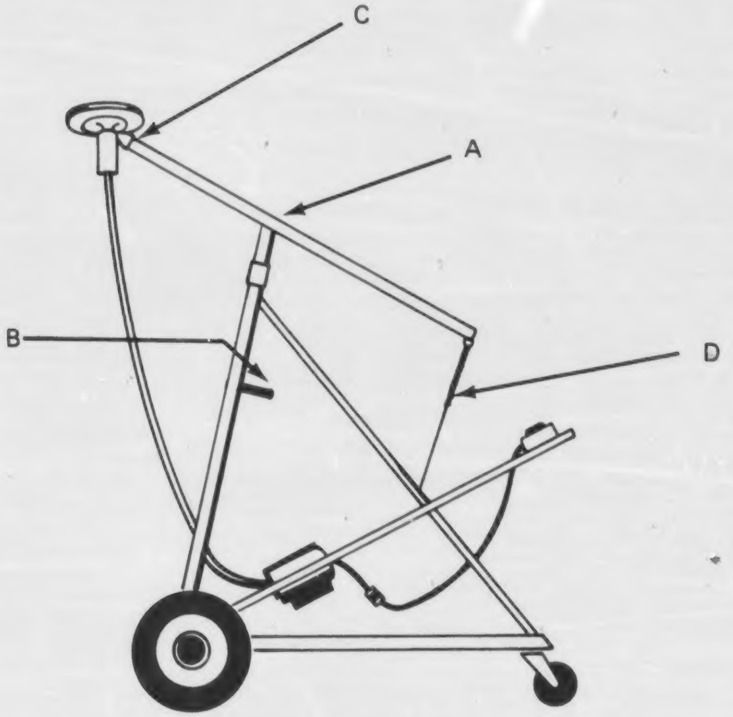
   F. Gloves

II. Procedure

   A. Plug grinder into drop cord

   B. Set pivot arm at about a 45° angle (Figure 1, Point A)

FIGURE 1



JOB SHEET #4

C. Adjust grinder head to proper height by lifting up on handle (Figure 1, Point B)

D. Adjust grinder head at a slight angle by adjusting turnbuckle (Figure 1, Point C)

E. Put slight pressure on grinding disc by the spring and chain assembly (Figure 1, Point D)

(CAUTION: Relieve pressure at Point D before starting motor.)

F. Start motor and gradually apply pressure to grinder head

G. Grind off nails, fins, and other obstructions by moving grinder in a back and forth motion

H. Continue this procedure until entire ceiling has been ground

GRINDING, RUBBING, AND SACKING
UNIT II

TEST

1. Match terms on the right to the proper definitions by placing the correct numbers in the blanks provided.

______a. Process of rubbing or grinding concrete

______b. Process of grinding with power grinder and water

______c. Process of finishing a wall

______d. Process of filling form tie holes, honeycomb, and any other defects in concrete

______e. Mixture of sand, cement, and water

______f. Cavity or pit in concrete

______g. Material used to bond or adhere fresh concrete to hard concrete and/or concrete to another surface

______h. Wire or metal crosstie used to hold pressure of wet concrete and to maintain the proper wall thickness

______i. Plastic or wood; assures proper setback and acts as positive spreader for forms

______j. Apparatus used to apply a liquid in the form of a spray

______k. Chemical compound used to prevent evaporation of moisture from concrete

______l. Composition of cement and water fines worked to the surface of concrete

______m. Mark and projection formed by knotholes and impressions on forms

______n. Concrete that has oozed out of joints between form boards and has hardened as part of the wall

1. Curing agent
2. Form tie
3. Honeycomb
4. Form mark
5. Burlap
6. Bonding agent
7. Dust
8. Mud
9. Sacking
10. Rubbing
11. Wet grinding
12. Fins
13. Sprayer
14. Cone insert
15. Patching
16. Paste
17. Hawk
18. Hand stone

______o. Coarse, plain woven fabric usually of jute or hemp

______p. Sand and cement mixture proportioned about half and half

______q. Tool used to rub and grind concrete

______r. Tool used to hold material at ready when patching and/or plastering

2. Arrange in order the steps to follow when preparing a wall for rubbing and/or sacking. Place a "1" in the blank next to the first step, a "2" by the second step, and so forth.

______a. Remove cone inserts

______b. Dry-grind wall to remove form marks and fins

______c. Chip off heavy fins

______d. Break off form ties

______e. Fill form tie and cone insert holes and any honeycomb

3. Select from the list below two methods of rubbing. Circle correct letters.

a. Wet stone

b. Hand stone

c. Sand stone

d. Wet grinding with power grinder

4. Name three reasons for rubbing and/or sacking walls.

a.

b.

c.

5. Discuss in a few words the proper time to rub and sack.

6. Select from the list below results of premature grinding. Place an "X" in the proper blanks.

______a. Large aggregate pulled out

______b. Steel pulled out

______c. Forms loosened

______d. Too much surface fines taken off

______e. Large aggregate loosened

7. Name four reasons for grinding a floor.

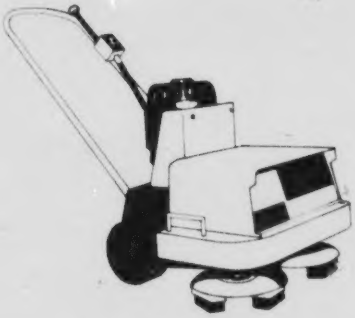
a.

b.

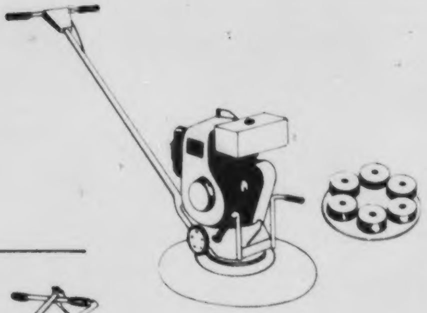
c.

d.

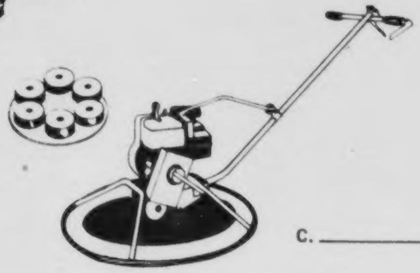
8. Identify the types of grinders below by writing the names in the blanks provided.



a. ______________________



b. ______________________



c. ______________________

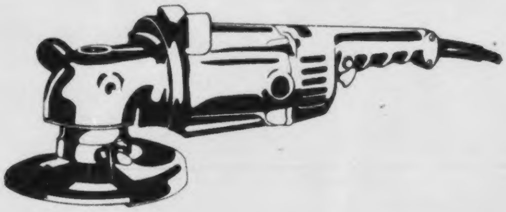
9. Name three reasons for grinding a ceiling.

a.

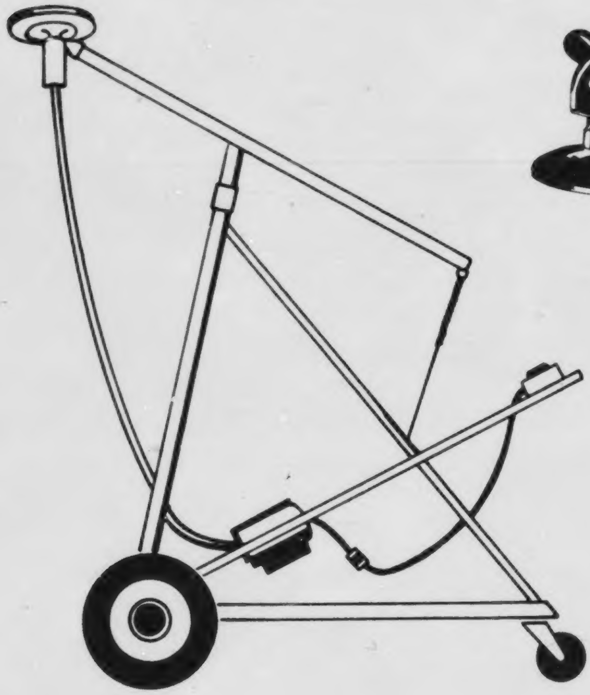
b.

c.

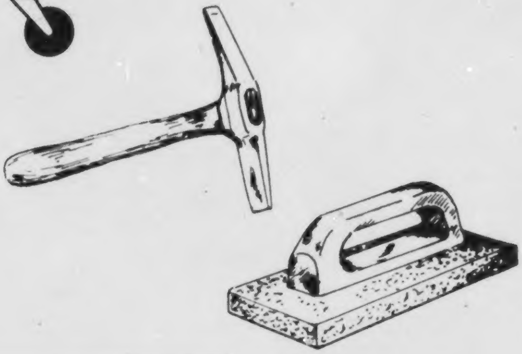
10. Identify the types of grinding equipment below by writing the appropriate names in the blanks provided.



b. ______________________



a. ______________________



c. ______________________

11. Demonstrate the ability to:

a. Rub a wall.

b. Sack a wall.

c. Grind and finish a floor.

d. Grind a ceiling.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

GRINDING, RUBBING, AND SACKING
UNIT II

ANSWERS TO TEST

1. a. 10
   b. 11
   c. 9
   d. 15
   e. 8
   f. 3
   g. 6
   h. 2
   i. 14
   j. 13
   k. 1
   l. 16
   m. 4
   n. 12
   o. 5
   p. 7
   q. 18
   r. 17

2. a. 3
   b. 4
   c. 2
   d. 1
   e. 5

3. b, d

4. a. Improve appearance
   b. Seal surface from exposure
   c. Fill voids in preparation for painting or other type of finish

5. After forms have been removed and concrete is hard enough to dry-grind without loosening or pulling out aggregates

6. a, d, e

7. a. Surface rained on
   b. Surface scaled from freeze
   c. Old floor resurfaced
   d. Grind off high spots

8. a. Commercial floor grinder
   b. Power float with grinder attachment
   c. Trowel machine with grinder attachment

9. a. Prepare ceiling for rubbing
   b. Prepare ceiling for tile
   c. Prepare ceiling for painting
10. a. Ceiling grinder
   b. Portable grinder
   c. Hand grinders--Chipping hammer and hand stone
11. Performance skills evaluated to the satisfaction of the instructor

SURFACE DEFECTS
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name types of defects and to match defects to their causes. He should be able to name techniques used to prevent defects and to demonstrate the ability to resurface a floor with underlayment. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with surface defects to the correct definitions.
2. Name types of defects.
3. Match types of defects to the causes.
4. Name techniques used to prevent defects.
5. Select from a list remedies for defects.
6. Demonstrate the ability to resurface floor with underlayment.

SURFACE DEFECTS
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information sheet.

  C. Discuss terminal and specific objectives.

  D. Discuss information sheet.

  E. Demonstrate and discuss procedures outlined in the job sheet.

  F. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheet.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objective sheet

  B. Information sheet

  C. Job Sheet #1--Resurface Floor with Underlayment

  D. Test

  E. Answers to test

II. References:

  A. *Guide to Better Concrete Finishes.* Elmhurst, Illinois: Concrete Construction Publications, Inc., 1968.

  B. *Cement Mason's Manual for Residential Construction.* Skokie, Illinois: Portland Cement Association, 1960.

SURFACE DEFECTS
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Scaling--Breaking away of a hardened concrete surface, usually to a depth of 1/16" to 3/16"

   B. Crazing--Fine hair cracks in the surface of newly hardened slabs due to surface shrinkage

   C. Dusting--When surface of hardened concrete is soft enough to powder

   D. Blemishes--Imperfections in color and finish

   E. Slab--Poured concrete floor

   F. Deicing compound--Compound applied to concrete to thaw ice and snow

   G. Bleed water--Water that comes to the surface after concrete has been placed

   H. Curing--Process of retaining moisture within the concrete, supplying moisture to the concrete, and protecting against extreme temperature changes

   I. Efflorescence--Deposits of soluble salts that form on surface of concrete caused by excessive mix water and calcium chloride

   J. Burnish finish--Very hard trowel finish that turns surface to a blue-black color

   K. Underlayment--Material used to resurface and/or build up a floor

II. Types of defects

   A. Scaling

   B. Crazing

   C. Dusting

   D. Blemishes

INFORMATION SHEET

III. Types of defects and the causes

A. Scaling

1. Freezing and thawing
2. Deicing compounds
3. Finishing while bleed water is still evident

B. Crazing

1. Too rapid surface drying
2. Overuse of placing tools
3. Premature finishing

C. Dusting

1. Improper concrete mix
2. Carbon dioxide from heaters or power equipment
3. Heat concentrated on concrete
4. Premature finishing
5. Improper or inadequate curing
6. Too rapid drying

D. Blemishes

1. Improper concrete mix
2. Concrete from different plants
3. Efflorescence
4. Stains
5. Burnish finish
6. Improper curing
7. Rain pits

INFORMATION SHEET

IV. Techniques used to prevent defects

  A. Maintain temperature of concrete above 50° for at least five days

  B. Use air-entrained concrete

  C. Do not finish until bleed water has evaporated

  D. Apply fog spray

  E. Cover slab as soon as it has been placed and bullfloated

  F. Do not overwork concrete while still too plastic

  G. Vent area where heaters and/or power equipment are used

  H. Do not concentrate heat directly on concrete

  I. Use proper curing methods and agents

  J. Avoid supply from more than one plant

V. Remedies for defects

  A. Grind surface

  B. Resurface with underlayment

  C. Thaw frozen concrete slowly

  D. Use several applications of curing agents

  E. Scrub with a mild acid solution or commercial cleaning solution

SURFACE DEFECTS
UNIT III

JOB SHEET #1--RESURFACE FLOOR WITH UNDERLAYMENT

I. Tools and materials

   A. Tools

      1. Finishing trowel

      2. Margin trowel

      3. Brush

      4. Broom

      5. Bucket

      6. Sprayer

   B. Materials

      1. Underlayment

         (NOTE: Most underlayments come in two components, cement and liquid latex. Latex is usually used as a bond coat.)

      2. Water in bucket

      3. Curing agent

II. Procedure

   A. Clean area to be repaired

      (CAUTION: Be sure all loose concrete has been removed.)

   B. Use brush and latex to paint area to be repaired

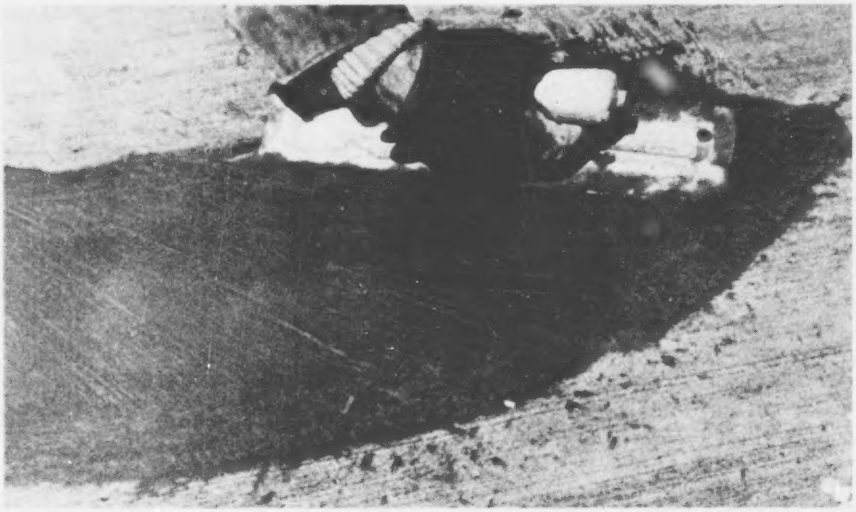
   C. Mix underlayment according to manufacturer's recommendations and apply small amount to floor

   D. Use finishing trowel tilted at about 45° angle, moving trowel from right to left carrying the underlayment with it

JOB SHEET #1

(NOTE: When using finishing trowel, tilt trowel and reach out at arm's length. Move trowel from right to left in a semicircular motion. Then tilt trowel opposite and move back from left to right barely lapping first pass. See Figure 1.)

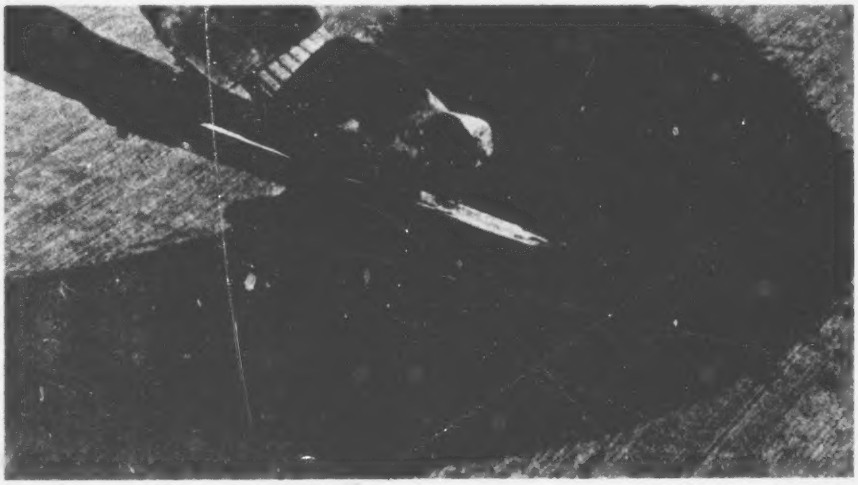
FIGURE 1



E. Move trowel back from left to right, continuing to carry the underlayment with it

(NOTE: As each pass is made, leave just enough underlayment on floor to fill voids. See Figure 2.)

FIGURE 2



JOB SHEET #1

F. Continue this procedure until area is covered

G. Reach out and retrowel entire area using trowel just barely tilted

(NOTE: This will take out trowel marks and leave floor surface relatively smooth.)

H. Move backwards and continue this procedure until entire area has been resurfaced

I. Apply curing agent as soon as possible without damaging surface

SURFACE DEFECTS
UNIT III

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Breaking away of a hardened concrete surface, usually to a depth of 1/16" to 3/16"

_____b. Fine hair cracks in the surface of newly hardened slabs due to surface shrinkage

_____c. When surface of hardened concrete is soft enough to powder

_____d. Imperfections in color and finish

_____e. Compound applied to concrete to thaw ice and snow

_____f. Poured concrete floor

_____g. Water that comes to the surface after concrete has been placed

_____h. Process of retaining moisture within the concrete, supplying moisture to the concrete, and protecting against extreme temperature changes

_____i. Deposits of soluble salts that form on surface of concrete caused by excessive mix water and calcium chloride

_____j. Very hard trowel finish that turns surface to a blue-black color

_____k. Material used to resurface and/or build up a floor

1. Dusting
2. Deicing compound
3. Efflorescence
4. Scaling
5. Curing
6. Burnish finish
7. Crazing
8. Blemishes
9. Bleed water
10. Slab
11. Underlayment

2. Name four types of defects.

a.

b.

c.

d.

3. Match the types of defects on the right to their causes by placing the number(s) in the blanks.

______a. Improper concrete mix

______b. Carbon dioxide from heaters or power equipment

______c. Concrete from different plants

______d. Efflorescence

______e. Premature finishing

______f. Stains

______g. Heat concentrated on concrete

______h. Improper or inadequate curing

______i. Burnish finish

______j. Rain pits

______k. Freezing and thawing

______l. Too rapid surface drying

______m. Deicing compounds

______n. Overuse of placing tools

______o. Finishing while bleed water is still evident

1. Dusting
2. Blemishes
3. Scaling
4. Crazing

4. Name five techniques used to prevent defects.

a.

b.

c.

d.

e.

5. Select from the list below the five remedies for defects. Circle the correct letters.

a. Wet down surface

b. Apply a bonding agent

c. Scrub with a mild acid solution or commercial cleaning solution

d. Apply a lot of heat and thaw area fast

e. Resurface with underlayment

f. Grind surface

g. Scrub with a strong acid

   h. Thaw frozen concrete slowly

   i. Bushhammer surface

   j. Use several applications of curing agents

6. Demonstrate the ability to resurface floor with underlayment.

   (NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

SURFACE DEFECTS
UNIT III

ANSWERS TO TEST

1.
   - a. 4
   - b. 7
   - c. 1
   - d. 8
   - e. 2
   - f. 10
   - g. 9
   - h. 5
   - i. 3
   - j. 6
   - k. 11
2.
   - a. Scaling
   - b. Crazing
   - c. Dusting
   - d. Blemishes
3.
   - a. 1, 2
   - b. 1
   - c. 2
   - d. 2
   - e. 1, 4
   - f. 2
   - g. 1
   - h. 1, 2
   - i. 2
   - j. 2
   - k. 3
   - l. 1, 4
   - m. 3
   - n. 4
   - o. 3
4. Any five of the following are acceptable.
   - a. Maintain temperature of concrete above 50° for at least five days
   - b. Use air-entrained concrete
   - c. Do not finish until bleed water has evaporated
   - d. Apply fog spray
   - e. Cover slab as soon as it has been placed and bullfloated
   - f. Do not overwork concrete while still too plastic
   - g. Vent area where heaters and/or power equipment are used
   - h. Do not concentrate heat directly on concrete

   i. Use proper curing methods and agents

   j. Avoid supply from more than one plant

5. c, e, f, h, j

6. Performance skill evaluated to the satisfaction of the instructor

CEMENT MASON'S

PROGRESS CHART

Section I
Surface Treatment

	UNIT I Patching				UNIT II Grinding Rubbing, and Sacking					UNIT III Surface Defects										
	1	2	3	4	1	2	3	4	5	1	2	3								
Job / **Student's Name**	UNIT TEST	Patch Deep Hole in Wall	Patch Hole in Wall Where Water Pressure Exists	Repair Hole in Finished Floor	UNIT TEST	Rub a Wall	Sack a Wall	Grind and Finish a Floor	Grind a Ceiling	UNIT TEST	Resurface Floor with Underlayment									
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct	Flush with existing wall	Flush with existing wall	Edges Flush with Floor Patch-Level and True to Existing Floor	85% Correct	Smooth Finish	Smooth Finish	± 1/8" in 10' Smooth Finish	Smooth Finish	85% Correct	Smooth Finish									
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

SMALL ENGINE OPERATION
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match terms associated with small engines. He should be able to identify operating positions, valve parts, and valve failures and describe the operation of small engines. He should be able to disassemble and reassemble a small gasoline engine. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with small engine operation to the correct definitions.
2. Name machines that are powered by small gasoline engines.
3. Identify the three basic operating positions of small gasoline engines.
4. Describe the four principal events in the operation of a four-cycle engine.
5. Describe a two-cycle engine and a four-cycle engine.
6. Name the advantages of an air-cooled engine.
7. Discuss the rule for testing compression.
8. Identify the parts of a valve.
9. Identify the types of valve failure.
10. Complete an engine inspection chart.
11. Demonstrate the ability to:
    a. Disassemble a small gasoline engine.
    b. Reassemble a small gasoline engine.

SMALL ENGINE OPERATION
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide students with objective sheet.
- B. Provide students with information, job, and assignment sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information and assignment sheets.
- F. Demonstrate and discuss procedures outlined in the job sheets.
- G. Give test.

II. Students:

- A. Read objective sheet.
- B. Study information sheet.
- C. Complete assignment sheet and turn in to instructor.
- D. Demonstrate the ability to accomplish the procedures outlined in the job sheets.
- E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Machines Powered by Small Engines
  2. TM 2--Machines Powered by Small Engines (Continued)

   3. TM 3--Engine Operating Positions
   4. TM 4--Principal Events in the Operating Cycle of an Engine
   5. TM 5--Valve Parts
   6. TM 6--Types of Valve Failures

- D. Job sheets
   1. Job Sheet #1--Disassemble a Small Gasoline Engine
   2. Job Sheet #2--Reassemble a Small Gasoline Engine
- E. Assignment Sheet #1--Engine Inspection Chart
- F. Test
- G. Answers to test

II. References:

A. *Small Engine Care, Operation, Maintenance, and Repair.* Volume I. American Association for Agricultural Engineering and Vocational Agriculture.

B. *Briggs and Stratton Repair Instructions III.* Milwaukee, Wisconsin: Briggs and Stratton Corporation.

C. *General Theories of Operation.* Milwaukee, Wisconsin: Briggs and Stratton Corporation.

D. *Small Gasoline Engines: Student Handbook.* University Park, Pennsylvania: Pennsylvania State University, College of Agriculture, Department of Agricultural Education.

SMALL ENGINE OPERATION
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Camshaft--Shaft containing lobes or cams to operate the engine valves

B. Carburetor--Device for automatically mixing fuel in the proper proportion with air to produce a combustible gas

C. Combustion--Process of burning

D. Combustion chamber--Volume of the cylinder above the piston with the piston on top center

E. Compression--Reduction in volume or the squeezing of a gas

F. Condenser--Device for temporarily collecting and storing a surge or electrical current for later discharge

G. Conductor--Material along or through which electricity will flow with a slight resistance

H. Connecting rod--Rod that connects the piston to the crankshaft

I. Crankcase--Housing in which the crankshaft and many other parts of the engine operate

J. Crankshaft--Main shaft of the engine which, in conjunction with the connecting rods, changes the reciprocating motion of the pistons into rotary motion

K. Cylinder--Round hole having some depth bored to receive a piston; sometimes referred to as a bore or a barrel

L. Cylinder block--Largest single part of an engine; the basis or main mass of metal in which the cylinders are bored or placed

M. Cylinder head--Detachable portion of an engine fastened securely to the cylinder block which contains all or a portion of the combustion chamber

N. Exhaust pipe--Pipe connecting the engine to the muffler to conduct the exhausted gases away from the engine

O. Gasket--Anything used as a packing, such as a nonmetallic substance, placed between two metal surfaces to act as a seal

INFORMATION SHEET

P. Governor--Device consisting of a control which is used to regulate engine speed

Q. Ignition system--Means for igniting the fuel in the cylinder, includes the spark plug, wiring, ignition breaker points, condenser, ignition coil, and source of electricity

R. Intake valve--Valve which permits a fluid or gas to enter the chamber and which seals the exit

S. Piston--Cylindrical part closed at one end which is connected to the crankshaft by the connecting rod

T. Piston head--Part of the piston above the rings

U. Piston pin--Journal for the bearing in the small end of an engine connecting rod which also passes through piston walls; also known as a wrist pin

V. Piston ring--Expanding ring placed in the grooves of the piston to provide a seal to prevent the passage of fluid or gas past the piston

W. Score--Scratch, ridge, or groove marring a finished surface

X. Spark--Electrical current possessing sufficient pressure to jump through the air from one conductor to another

Y. Spark gap--Space between the electrodes of a spark plug through which the spark jumps

Z. Spark plug--Device inserted into the combustion chamber of an engine containing an insulated control electrode for conducting current

AA. Stroke--Distance moved by the piston

BB. Valve--Device for opening and closing the openings that admit the air and gas mixture into the cylinder

CC. Vapor lock--Condition whereby the fuel boils in the fuel system forming bubbles which retard or stop the flow of fuel to the carburetor

II. Machines powered by small engines (Transparencies 1 and 2)

A. Trowel machine

B. Power float

C. Power grinder

D. Vibrating straightedge

INFORMATION SHEET

E. Power saw

F. Power sprayer

G. Portable mixer

III. Operating positions (Transparency 3)

A. Vertical

B. Horizontal

C. Multi-position

IV. Events of a 4-cycle engine (Transparency 4)

A. Intake stroke

1. Exhaust valve is closed
2. Intake valve is open
3. Piston moves downward and the air/fuel mixture is drawn into the cylinder

B. Compression

1. Intake valve closes
2. Piston moves upward
3. Air/fuel mixture is compressed

C. Power

1. Spark occurs, igniting the mixture
2. Forces of expanding gases push the piston down

D. Exhaust

1. Exhaust valve opens
2. Upward movement of piston forces the burned gases out of the cylinder
3. Exhaust valve closes
4. Cycle is repeated

INFORMATION SHEET

V. Engines

  A. 4-cycle

    1. Two revolutions of crankshaft per firing

    2. Lubricated from crankcase oil in the sump

  B. 2-cycle

    1. One revolution of crankshaft per firing

    2. Lubricated from oil mixed with the gasoline

VI. Advantages of air-cooled engines

  A. No need for complicated cooling system

  B. Lighter in weight and occupy less space

  C. Easy to repair

VII. Rule for testing compression--Give the flywheel a quick spin and if it rebounds on the compression stroke, the compression is at least good enough to start the engine

VIII. Parts of a valve (Transparency 5)

  A. Head

  B. Margin

  C. Seat

  D. Face

  E. Stem

  F. Valve guide

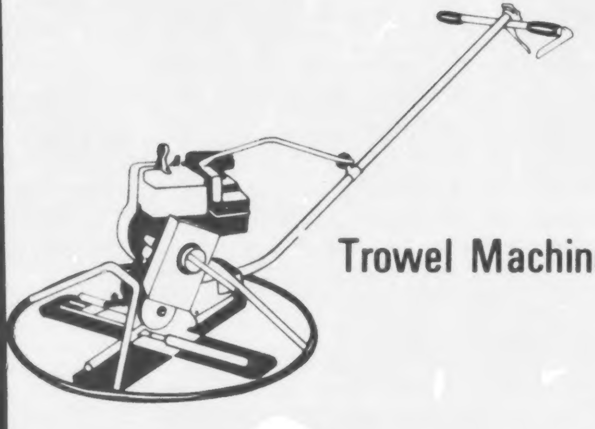
IX. Valve failures (Transparency 6)

  A. Burned

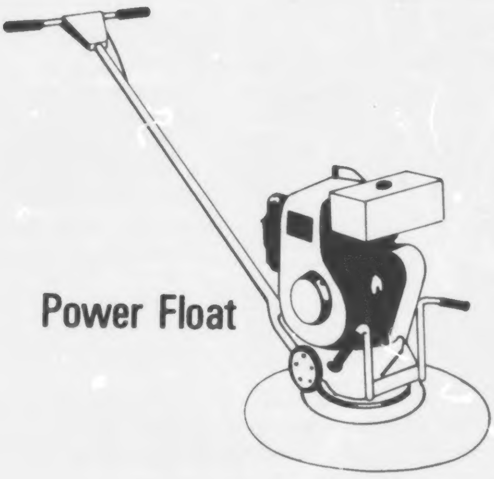
  B. Necked

  C. Dished

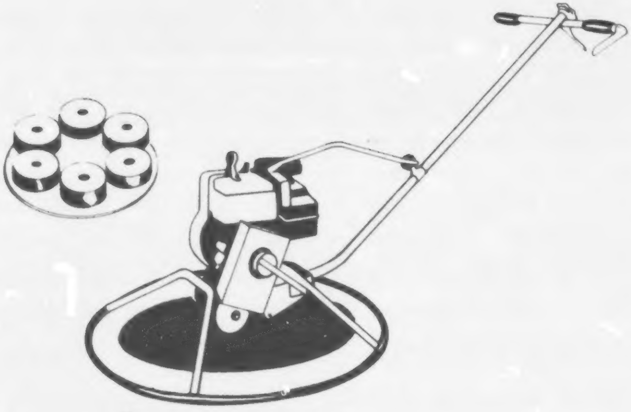
Machines Powered by Small Engines



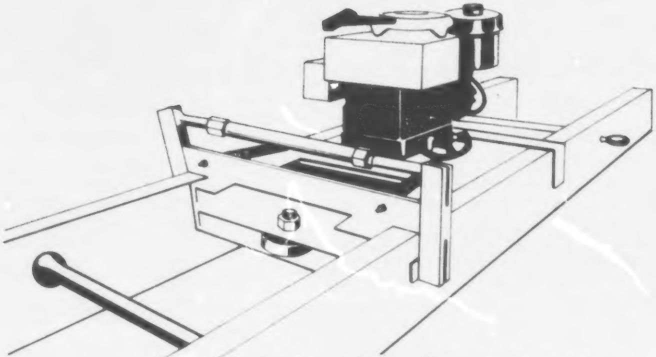
Trowel Machine



Power Float



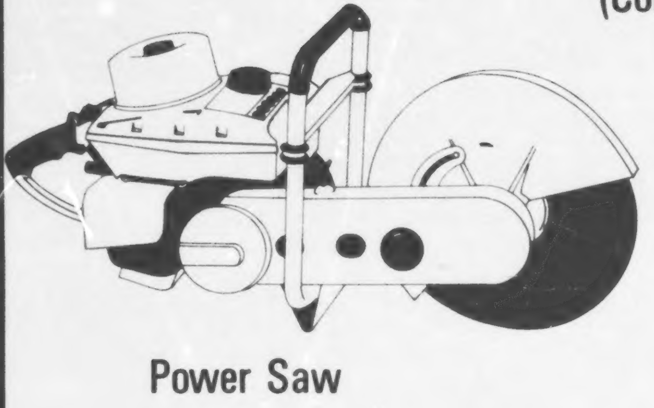
Power Grinder



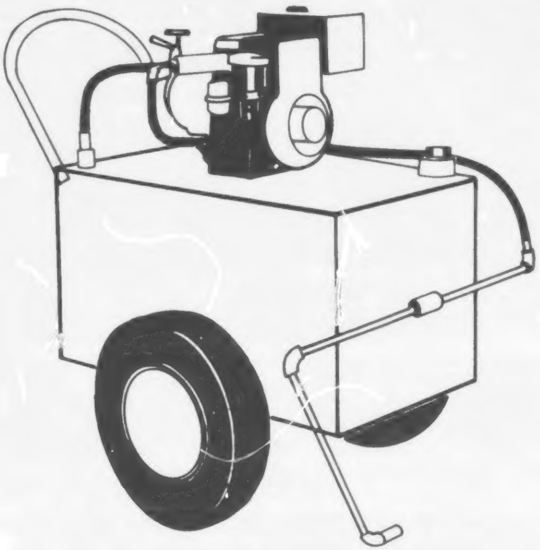
Vibrating Straightedge

Machines Powered by Small Engines

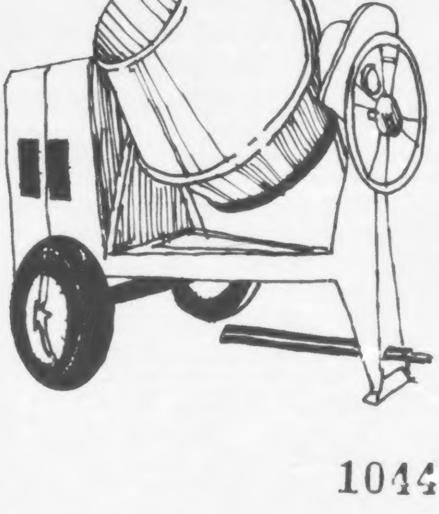
(Continued)



Power Saw

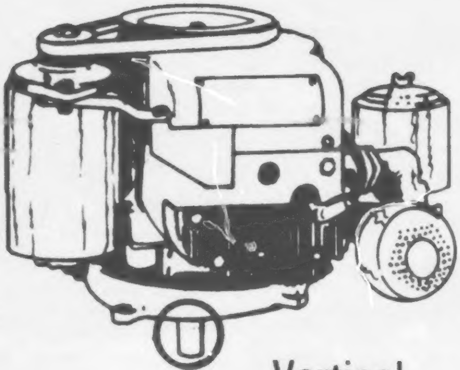


Power Spray

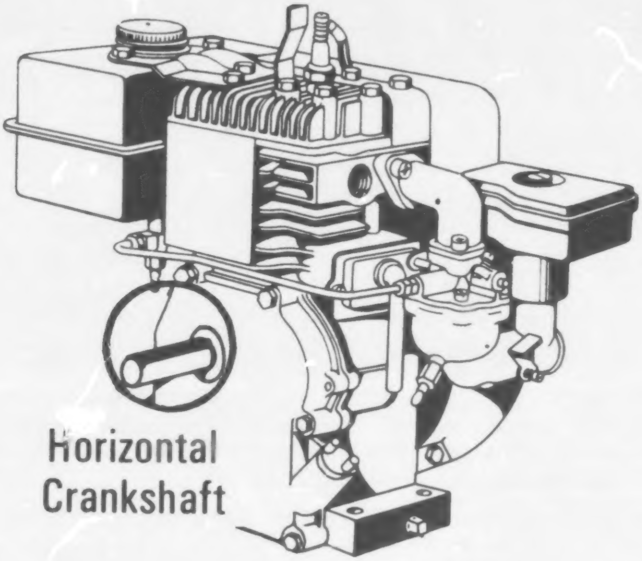


Portable Mixer

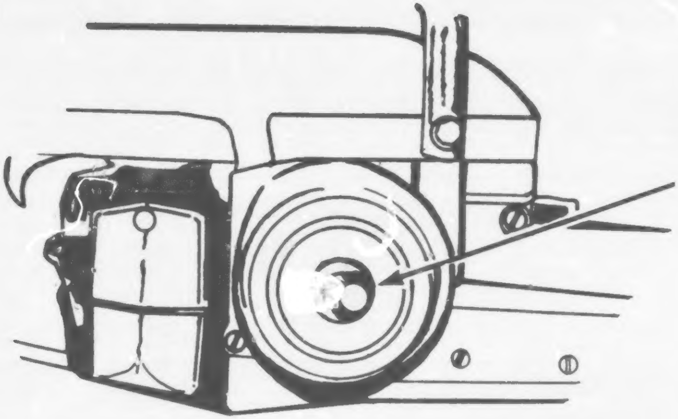
Engine Operating Positions



Vertical Crankshaft

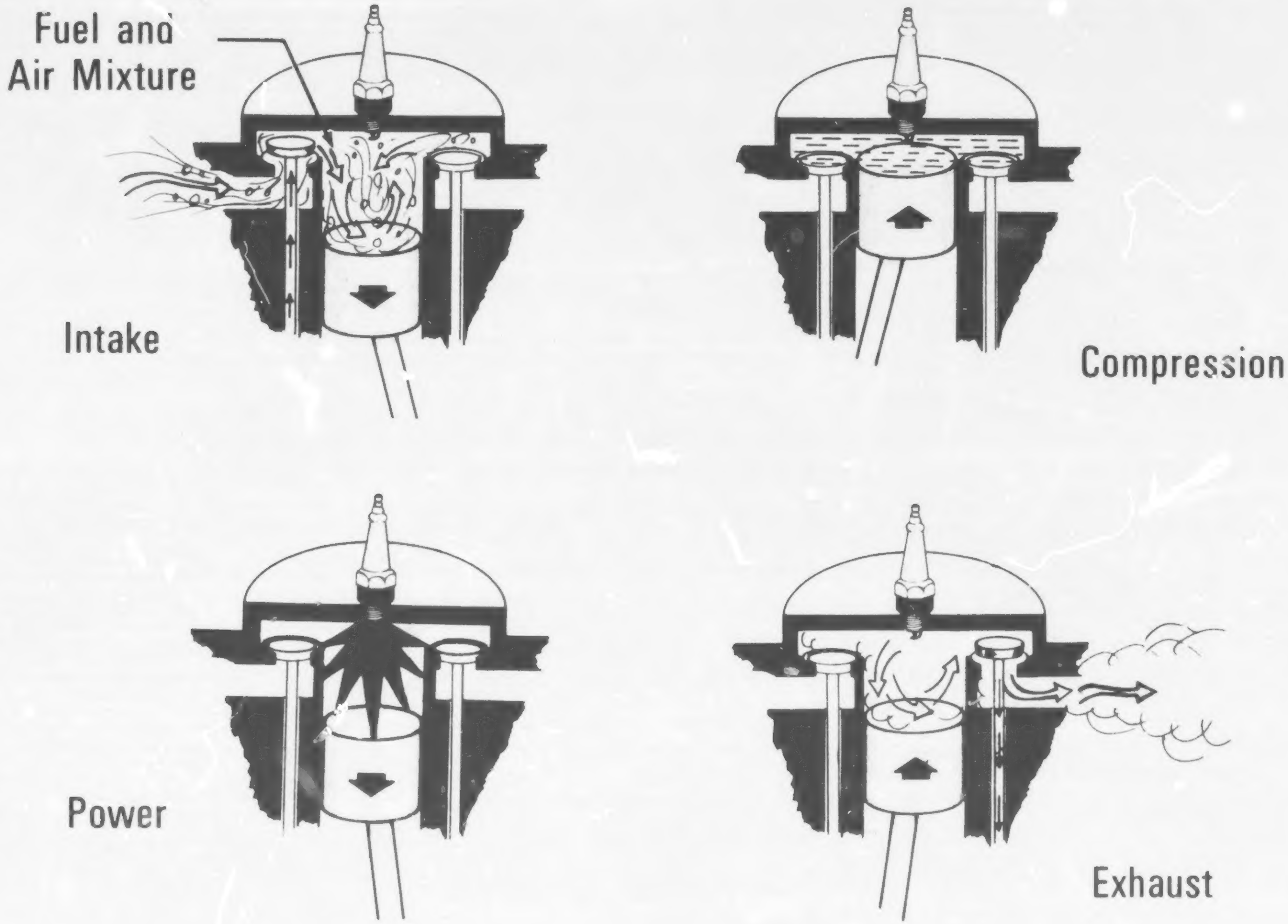


Horizontal Crankshaft



Multi-Position Crankshaft

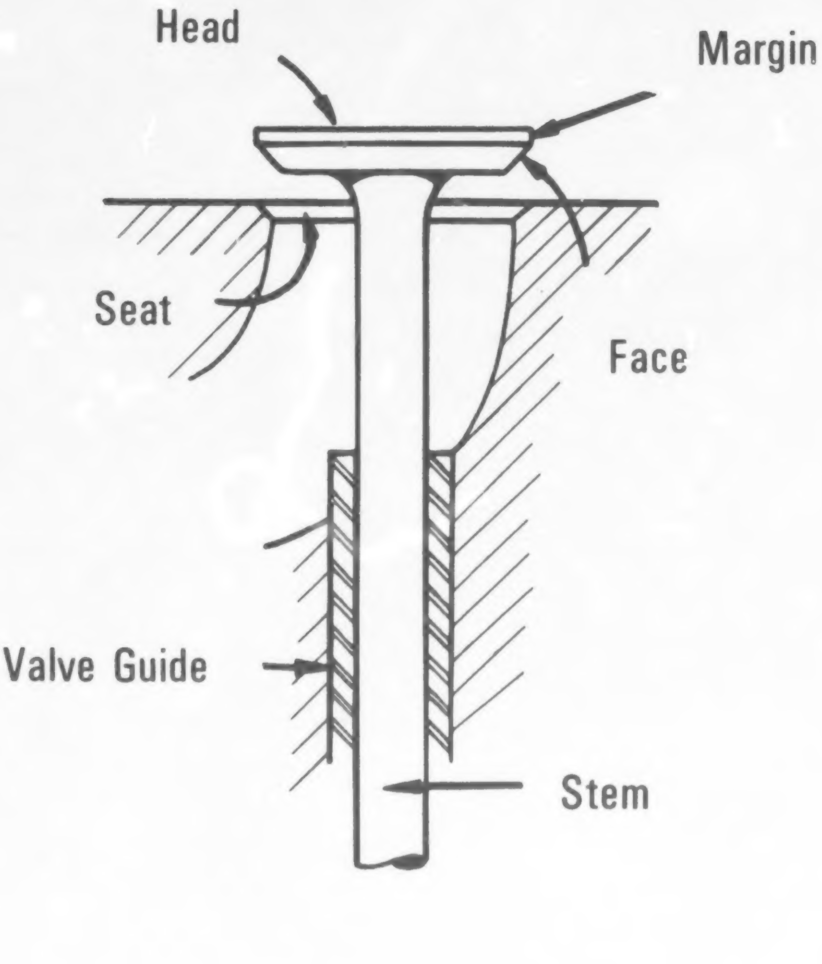
Principal Events in the Operating Cycle of an Engine


Fuel and
Air Mixture
Intake
Compression
Power
Exhaust

TM 4

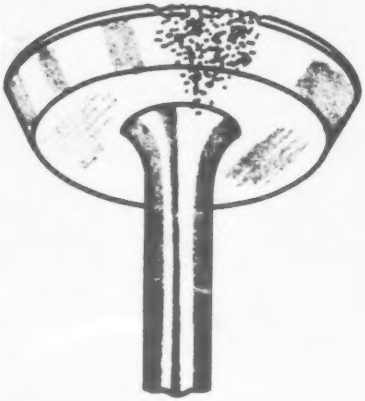
CM - 15-J

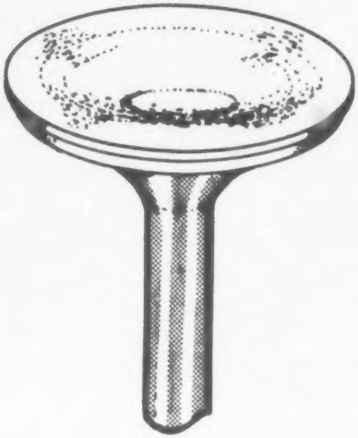
Valve Parts


Head
Margin
Seat
Face
Valve Guide
Stem

Types of Valve Failures

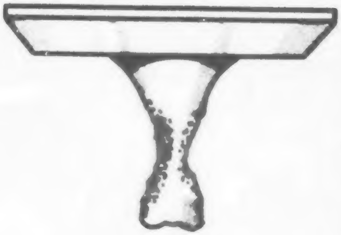
Burned





Dished

Necked



SMALL ENGINE OPERATION
UNIT I

JOB SHEET #1--DISASSEMBLE A SMALL GASOLINE ENGINE

I. Tools and materials

   A. 4-cycle engine

   B. Socket set, 3/8" drive

   C. Combination wrench set

   D. Standard screwdriver

   E. Soft mallet

   F. Adjustable wrench

   G. Punches

   H. Ring compressor

   I. Flywheel puller

   J. Starter wrench

   K. Flywheel holder

   L. Spring compressor

   M. Container for holding parts

II. Procedure

   A. Drain oil

   B. Remove air cleaner stud and wing nut

   C. Remove fuel line

   D. Remove carburetor and linkage

   E. Remove carburetor intake elbow

   F. Remove muffler if necessary

   G. Remove shroud and check rewind starter

   H. Check compression

JOB SHEET #1

I. Remove spark plug

J. Check air gap, armature to flywheel

K. Remove governor blade

L. Remove breather assembly

M. Remove cylinder head and shield

N. Check tappet clearance

O. Remove valves and springs

P. Remove starter pulley or clutch

Q. Remove flywheel

R. Remove breaker point cover

S. Check contact point gap

T. Remove breaker points and check plunger hole

U. Check crankshaft end play

V. File burrs from crankshaft power take-off end

W. Remove base or sump

X. Remove oil slinger and bracket

Y. Remove cam gear

Z. Remove tappets

AA. Remove connecting rod and piston

BB. Remove crankshaft

CC. Test condenser

DD. Test coil

EE. Check cylinder bore, valve guides, and bearings

FF. Remove piston from connecting rod

JOB SHEET #1

GG. Check piston, rings, and piston pin

HH. Reface valves

II. Reseat valve seats

SMALL ENGINE OPERATION
UNIT I

JOB SHEET #2--REASSEMBLE A SMALL GASOLINE ENGINE

I. Tools and materials

- A. Socket set, 3/8" drive
- B. Combination wrench set
- C. Standard screwdriver
- D. Soft mallet
- E. Adjustable wrench
- F. Punch
- G. Ring compressor
- H. Starter wrench
- I. Flywheel holder
- J. Spring compressor

II. Procedure

- A. Install crankshaft
- B. Assemble piston pin and connecting rod
- C. Assemble rings to piston
- D. Install piston and connecting rod assembly
- E. Install tappets
- F. Install cam gear
- G. Install oil slinger, gear, and bracket
- H. Install base or sump with gasket
- I. Check and adjust crankshaft end play
- J. Install points, adjust gap, and clean
- K. Install point cover

JOB SHEET #2

L. Install flywheel

M. Install starter pulley or clutch

N. Install governor blade

O. Adjust armature air gap

P. Check spark

Q. Adjust valve tappet clearance

R. Install valves, springs, and retainers

S. Recheck valve tappet clearance

T. Install breather assembly

U. Install cylinder head and shield

V. Test, clean gap, and install spark plug

W. Check compression

X. Install muffler

Y. Install carburetor and linkage

Z. Check and align governor

AA. Install shroud housing

BB. Install fuel pipe

CC. Fill with oil

DD. Adjust carburetor

EE. Start engine

SMALL ENGINE OPERATION
UNIT I

ASSIGNMENT SHEET #1--ENGINE INSPECTION CHART

Engine: Make ________________ Model ________________ Serial No. ____________

Specification Number __________________ Horsepower ____________________

Operating Position of Crankshaft: Vertical_____, Horizontal_____, Multi-Position_____.

Engine Cycle: 2-Cycle_____, 4-Cycle_____.

TYPES OF ACCESSORIES AND MAJOR UNITS:

CARBURETOR AIR CLEANER: Oil bath ☐, Oiled filter ☐, Dry filter ☐.

FUEL STRAINER: Combination screen and sediment bowl ☐, Screen inside the fuel tank ☐.

CRANKCASE BREATHER: Reed valve ☐, Floating disk valve ☐.

STARTER: Rope-wind ☐, Rope-rewind ☐, Wind up ☐, Electric, AC ☐, Electric, DC ☐.

IGNITION SYSTEM: Flywheel magneto ☐, External magnet ☐, Battery ☐.

FUEL PUMP: Mechanically driven ☐, Differential pressure driven ☐.

CARBURETOR: Float ☐, Suction lift ☐, Diaphragm ☐.

GOVERNOR: Air vane ☐, Centrifugal ☐.

ASSIGNMENT SHEET #1

ITEM		STANDARD	ACTUAL	RECOMMENDATION	Parts No.
CYLINDER	Diameter				
	Out of Round	0			
	Taper	0			
RING GROOVE SIDE CLEARANCE					
RING END GAP	Compression				
	Oil				
CRANKSHAFT	*Magneto Journal				
Diameter	*Crankpin				
	*P.T.O. Journal				
	Magneto Journal	0			
Out of Round	Crankpin	0			
	P.T.O. Journal	0			
MAIN BEARINGS	Magneto Journal	Use go, no go gauge			
	P.T.O. Journal	Use go, no go gauge			
VALVE MARGIN		1/32"			
VALVE GUIDE		Use go, no go gauge			
BREAKER POINT PLUNGER HOLE		Use go, no go gauge			
TAPPET CLEARANCE	Intake				
	Exhaust				
BREAKER POINT GAP					
SPARK PLUG GAP					
ARMATURE AIR GAP					

SMALL ENGINE OPERATION
UNIT I

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. (Terms and definitions are continued on the following pages.)

______a. Shaft containing lobes or cams to operate the engine valves

______b. Device for automatically mixing fuel in the proper proportion with air to produce a combustible gas

______c. Process of burning

______d. Volume of the cylinder above the piston with the piston on top center

______e. Reduction in volume or the squeezing of a gas

______f. Device for temporarily collecting and storing a surge or electrical current for later discharge

______g. Material along or through which electricity will flow with a slight resistance

______h. Rod that connects the piston to the crankshaft

______i. Housing in which the crankshaft and many other parts of the engine operate

______j. Main shaft of the engine which, in conjunction with the connecting rods, changes the reciprocating motion of the pistons into rotary motion

______k. Round hole having some depth bored to receive a piston; sometimes referred to as a bore or a barrel

______l. Largest single part of an engine; the basis or main mass of metal in which the cylinders are bored or placed

1. Piston ring
2. Intake valve
3. Spark plug
4. Vapor lock
5. Governor
6. Cylinder head
7. Crankshaft
8. Camshaft
9. Condenser
10. Spark
11. Carburetor
12. Exhaust pipe
13. Piston head
14. Valve
15. Combustion chamber
16. Gasket
17. Ignition system
18. Spark gap
19. Cylinder
20. Combustion
21. Stroke
22. Score

_____m. Detachable portion of an engine fastened securely to the cylinder block which contains all or a portion of the combustion chamber

_____n. Pipe connecting the engine to the muffler to conduct the exhausted gases away from the engine

_____o. Anything used as a packing, such as a nonmetallic substance, placed between two metal surfaces to act as a seal

_____p. Device consisting of a control which is used to regulate engine speed

_____q. Means for igniting the fuel in the cylinder, including spark plugs, wiring, ignition, and distributor ignition coil; source of electrical supply

_____r. Valve which permits a fluid or gas to enter the chamber and which seals the exit

_____s. Cylindrical part closed at one end which is connected to the crankshaft by the connecting rod

_____t. Part of the piston above the rings

_____u. Journal for the bearing in the small end of an engine connecting rod which also passes through piston walls; also known as a wrist pin

_____v. Expanding ring placed in the grooves of the piston to provide a seal to prevent the passage of fluid or gas past the piston

_____w. Scratch, ridge, or groove marring a finished surface

_____x. Electrical current possessing sufficient pressure to jump through the air from one conductor to another

_____y. Space between the electrodes of a spark plug through which the spark jumps

_____z. Device inserted into the combustion chamber of an engine containing an insulated control electrode for conducting current

____aa. Distance moved by the piston

23. Cylinder block
24. Crankcase
25. Compression
26. Piston
27. Conductor
28. Connecting rod
29. Piston pin

____bb. Device for opening and closing the openings that admit the air and gas mixture into the cylinder

____cc. Condition whereby the fuel boils in the fuel system forming bubbles which retard or stop the flow of fuel to the carburetor

2. Name five machines that are powered by small gasoline engines.

   a.

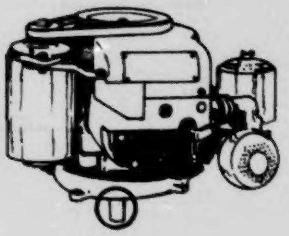
   b.

   c.

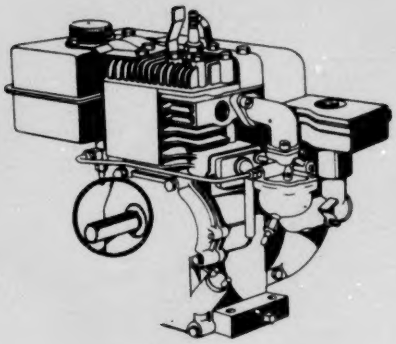
   d.

   e.

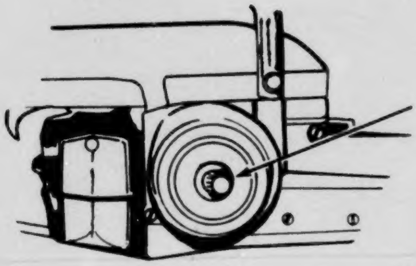
3. Identify from the drawings below the operating position of each engine.



a.____



b.____



c.____

4. Describe the four principal events in the operation of a 4-cycle engine.
   a. Intake stroke

   b. Compression

   c. Power

   d. Exhaust

5. Describe a 4-cycle and a 2-cycle engine.
   a. 4-cycle

   b. 2-cycle

6. Name three advantages of an air-cooled engine.

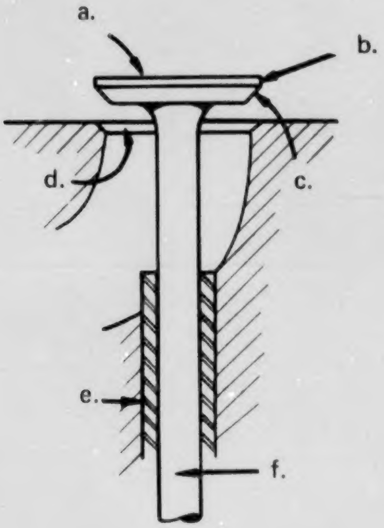
   a.

   b.

   c.

7. Discuss the rule for testing compression.

8. Identify the parts of a valve by writing the correct names in the blanks provided.



a. ____________________

b. ____________________

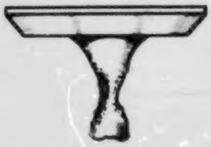
c. ____________________

d. ____________________

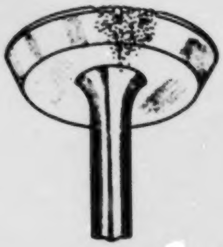
e. ____________________

f. ____________________

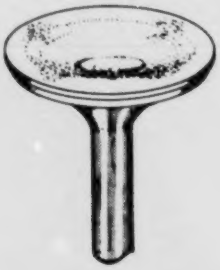
9. Identify the following types of valve failures.



a. ________________________________



b. ________________________________



c. ________________________________

10. Complete an engine inspection chart.

11. Demonstrate the ability to:

    a. Disassemble a small gasoline engine.

    b. Reassemble a small gasoline engine.

    (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SMALL ENGINE OPERATION
UNIT I

ANSWERS TO TEST

1.
   a. 8
   b. 11
   c. 20
   d. 15
   e. 25
   f. 9
   g. 27
   h. 28
   i. 24
   j. 7
   k. 19
   l. 23
   m. 6
   n. 12
   o. 16
   p. 5
   q. 17
   r. 2
   s. 26
   t. 13
   u. 29
   v. 1
   w. 22
   x. 10
   y. 18
   z. 3
   aa. 21
   bb. 14
   cc. 4

2. Any five of the following are acceptable.
   a. Trowel machine
   b. Power float
   c. Power grinder
   d. Vibrating straightedge
   e. Power saw
   f. Power sprayer
   g. Portable mixer

3.
   a. Vertical
   b. Horizontal
   c. Multi-position

4.
   a. Intake stroke
      1) Exhaust valve is closed
      2) Intake valve is open
      3) Piston moves downward and the air/fuel mixture is drawn into the cylinder

b. Compression

    1) Intake valve closes
    2) Piston moves upward
    3) Air/fuel mixture is compressed

c. Power

    1) Spark occurs, igniting the mixture
    2) Forces of expanding gases push the piston down

d. Exhaust

    1) Exhaust valve opens
    2) Upward movement of piston forces burned gases out of cylinder
    3) Exhaust valve closes
    4) Cycle is repeated

5. Description should include the following points.

    a. 4-cycle

        1) Two revolutions of crankshaft per firing
        2) Lubricated from crankcase oil in the sump

    b. 2-cycle

        1) One revolution of crankshaft per firing
        2) Lubricated from oil mixed with the gasoline

6. a. No need for complicated cooling system

    b. Lighter in weight and occupy less space

    c. Easy to repair

7. Give the flywheel a quick spin and if it rebounds on the compression stroke, the compression is at least good enough to start the engine

8. a. Head

    b. Margin

c. Face

d. Seat

e. Valve guide

f. Stem

9. a. Necked

b. Burned

c. Dished

10. Evaluated to the satisfaction of the instructor

11. Performance skills evaluated to the satisfaction of the instructor

SERVICING SMALL ENGINES
UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match terms associated with servicing small engines to the definitions. He should be able to identify the different types of air cleaners, fuel filters, carburetors, and magnetos and demonstrate skills in servicing small gasoline engines. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with servicing small engines to the correct definitions.
2. Name the solutions used in cleaning an engine.
3. Identify types of air cleaners.
4. Identify types of fuel filters.
5. Identify types of carburetors.
6. Identify types of magnetos.
7. Demonstrate the ability to:
    a. Clean and inspect crankcase and accessories.
    b. Clean and inspect cooling system.
    c. Service oil-bath air cleaner.
    d. Service oil-filter air cleaner.
    e. Service dry-filter air cleaner.
    f. Service sediment bowl fuel strainer.
    g. Service screen type fuel strainer.
    h. Service crankcase breather.
    i. Change crankcase oil.
    j. Check spark plug for proper operation.

k. Clean and service spark plugs.

l. Replace ignition contact points and condenser on internal magneto.

m. Replace ignition contact points and condenser on external magneto.

n. Service float type carburetor.

SERVICING SMALL ENGINES
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:
  A. Objective sheet
  B. Information sheet
  C. Transparency masters
    1. TM 1--Types of Air Cleaners
    2. TM 2--Types of Fuel Filters
    3. TM 3--Types of Carburetors
    4. TM 4--Types of Magnetos
  D. Job sheets
    1. Job Sheet #1--Clean and Inspect Crankcase and Accessories
    2. Job Sheet #2--Clean and Inspect Cooling System

3. Job Sheet #3--Service Oil-Bath Air Cleaner
4. Job Sheet #4--Service Oil-Filter Air Cleaner
5. Job Sheet #5--Service Dry-Filter Air Cleaner
6. Job Sheet #6--Service Sediment Bowl Fuel Strainer
7. Job Sheet #7--Service Screen Type Fuel Strainer
8. Job Sheet #8--Service Crankcase Breather
9. Job Sheet #9--Change Crankcase Oil
10. Job Sheet #10--Check Spark Plug for Proper Operation
11. Job Sheet #11--Clean and Service Spark Plugs
12. Job Sheet #12--Replace Ignition Contact Points and Condenser on Internal Magneto
13. Job Sheet #13--Replace Ignition Contact Points and Condenser on External Magneto
14. Job Sheet #14--Service Float Type Carburetor

E. Test

F. Answers to test

II. References:

A. *Small Engine Care, Operation, Maintenance, and Repair.* Volume I. American Association for Agricultural Engineering and Vocational Agriculture.

B. *Briggs and Stratton Repair Instructions III.* Milwaukee, Wisconsin: Briggs and Stratton Corporation.

C. *General Theories of Operation.* Milwaukee, Wisconsin: Briggs and Stratton Corporation.

D. *Small Gasoline Engines Student Handbook.* University Park, Pennsylvania: Pennsylvania State University, College of Agriculture, Department of Agricultural Education.

SERVICING SMALL ENGINES
UNIT II

INFORMATION SHEET

I. Terms and definitions

   A. Throttle valve--Device located in the manifold which controls the fuel and air

   B. Choke valve--Valve which provides a higher fuel-to-air ratio by restricting air inlet

   C. Spark gap--Space between the electrodes of a spark plug through which the spark jumps

   D. Detonation or knock--Hammering force on the piston rather than a uniform pushing force

   E. Air cleaner--Device for filtering, cleaning, and removing dust from the air admitted to a unit, such as an engine

   F. Carburetor--Device for automatically mixing fuel in the proper proportion with air to produce a combustible gas

   G. Magneto--Alternator with permanent magnets used to generate current for the ignition in an internal combustion engine

   H. Ignition contact points (breaker points)--Pair of points, one stationary and the other operated by a cam, to make and break the primary ignition circuit usually made of tungston, platinum, or silver

   I. Condenser--Device for temporarily collecting and storing a surge of electrical current for later discharge

II. Engine cleaning solutions

   A. Commercial solvent called *degreaser*

   B. Petroleum solvents

      1. Kerosene

      2. Diesel fuel

   C. Live steam

INFORMATION SHEET

III. Types of air cleaners (Transparency 1)

   A. Oil-bath

   B. Oiled-filter

   C. Dry-filter

IV. Types of fuel filters (Transparency 2)

   A. Combination screen and sediment bowl

   B. Screen in fuel tank

   C. Strainer on fuel pick-up hose

V. Types of carburetors (Transparency 3)

   A. Float

   B. Suction-lift

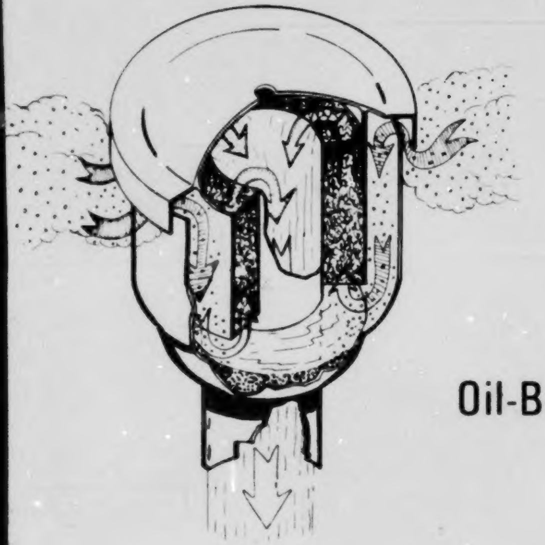
   C. Diaphragm

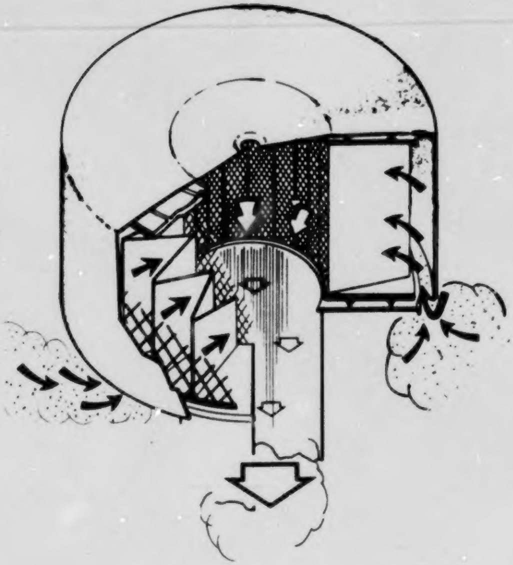
VI. Types of magnetos (Transparency 4)

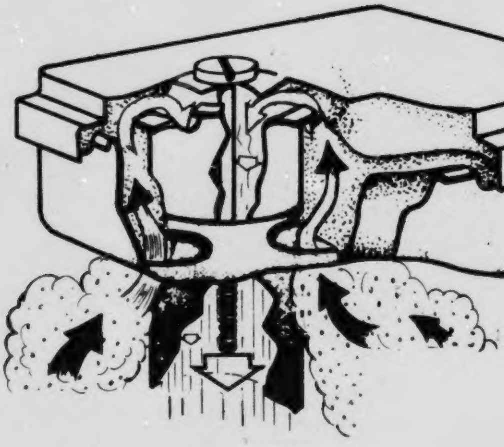
   A. Internal (flywheel) magneto

   B. External magneto

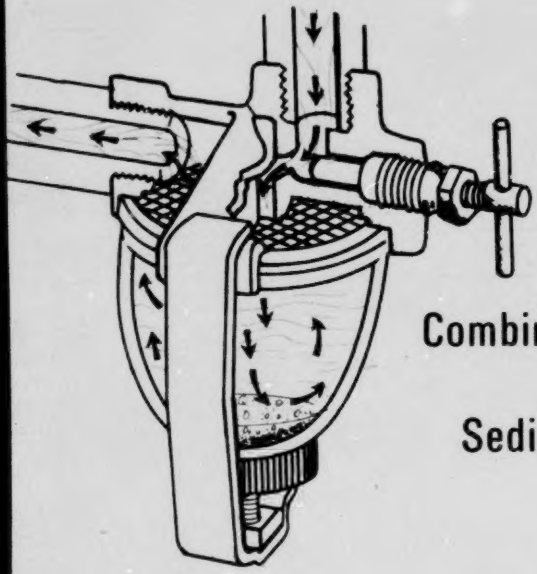
Types of Air Cleaners


Oil-Bath

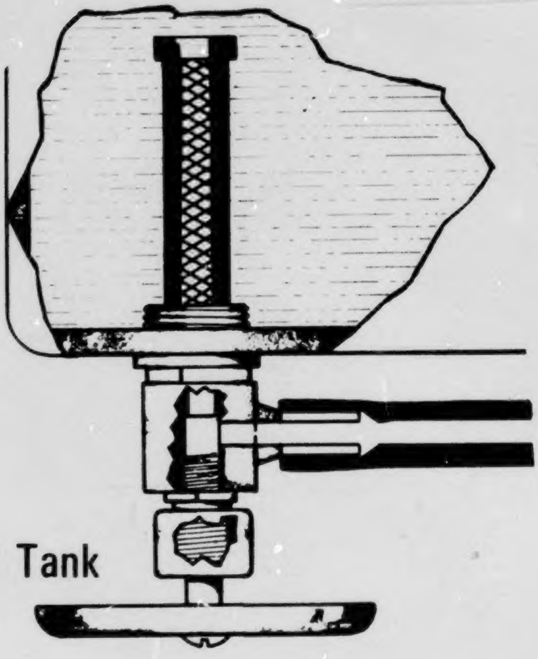

Dry-Filter


Oiled-Filter

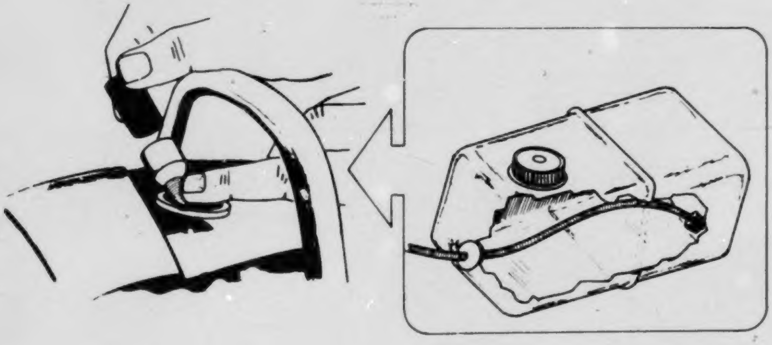
Types of Fuel Filters



Combination Screen
and
Sediment Bowl

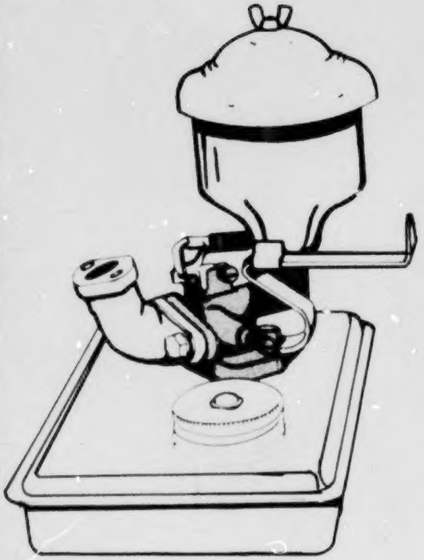


Screen in Fuel Tank

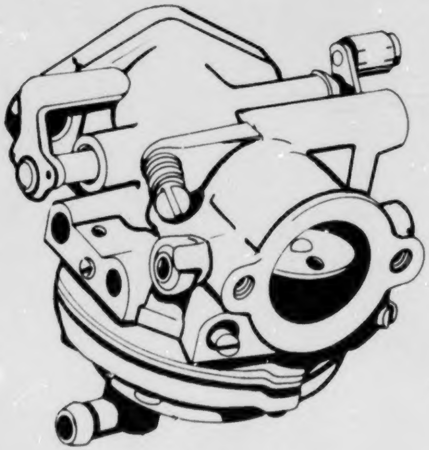


Strainer on Fuel
Pick-up Hose

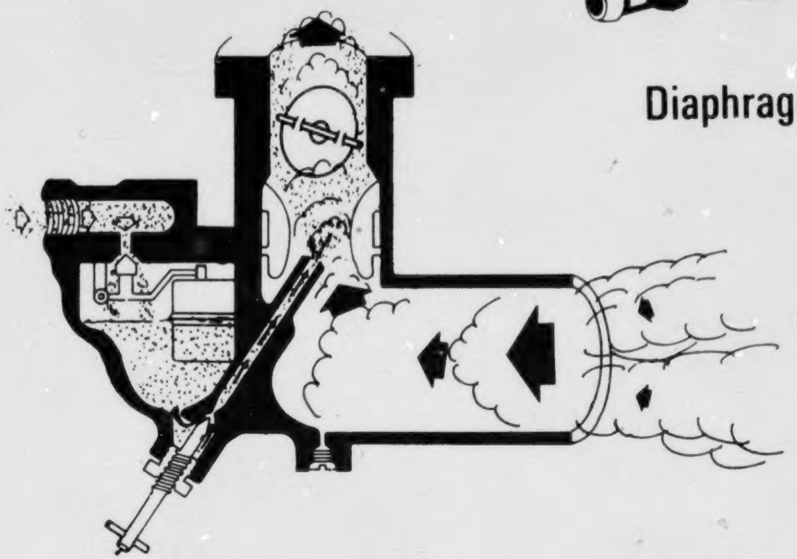
Types of Carburetors



Suction-Lift

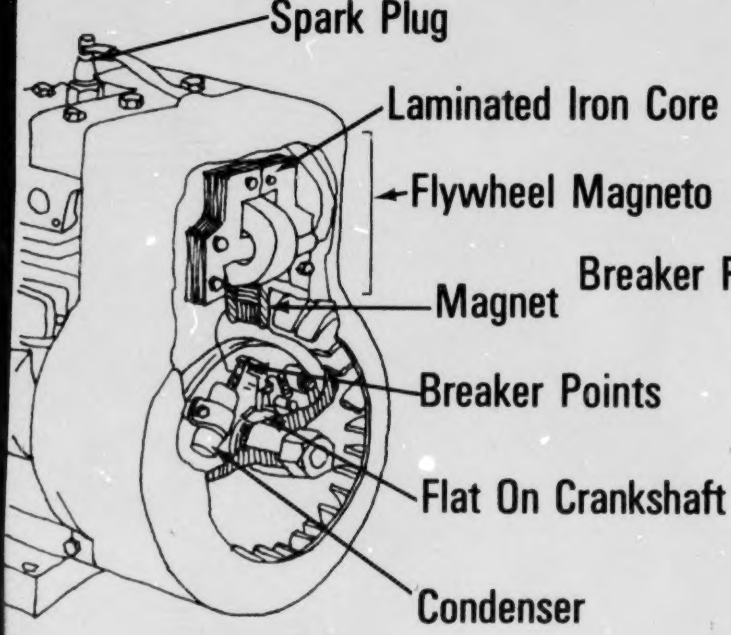


Diaphragm

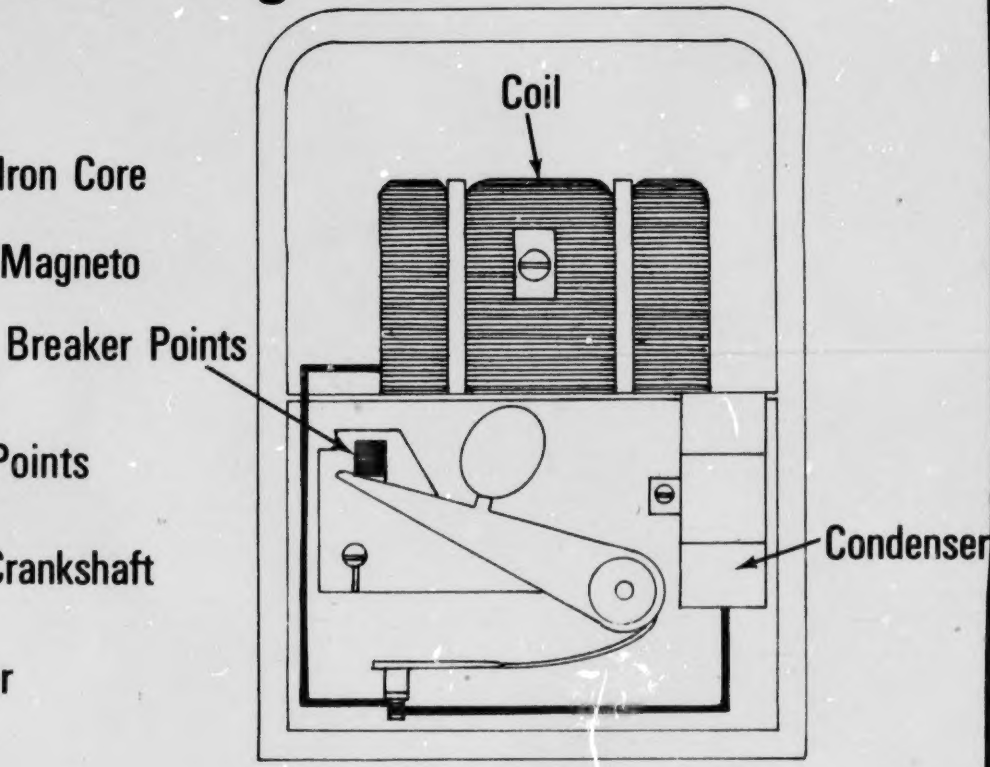


Float

Types of Magnetos


Spark Plug
Laminated Iron Core
Flywheel Magneto
Magnet
Breaker Points
Flat On Crankshaft
Condenser

INTERNAL (FLYWHEEL)


Coil
Breaker Points
Condenser

EXTERNAL

1075

[redacted]

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #1--CLEAN AND INSPECT CRANKCASE AND ACCESSORIES

I. Tools and materials

A. Standard screwdrivers, 4" and 6"

B. Phillips screwdrivers, 4" and 6"

C. Socket set including:

1. 3/8"
2. 7/16"
3. 1/2"
4. 5/8"
5. 9/16"
6. 3/8" ratchet

D. Open-end wrenches same as sockets

E. Wire brush

F. Empty pan for cleaning

G. Paint brush

H. Water hose with nozzle

I. Scraper or putty knife

J. Solvent

K. Hand sprayer

L. Fire extinguisher

(NOTE: Do not use gasoline for cleaning an engine. It is highly flammable and an extreme fire hazard. If a degreaser is used, check the instructions on the can.)

JOB SHEET #1

II. Procedure

A. Allow the engine to cool if it has been running

B. Remove the blower shroud and cylinder baffles

C. Inspect for oil and fuel leaks

D. Remove air cleaner and cover air cleaner opening

(NOTE: Cover carburetor intake with a piece of plastic sheeting. Use a rubber band to hold plastic in place.)

E. Clean the exhaust system

F. Apply solvent on areas that need cleaning

(NOTE: Apply with a paint brush or hand sprayer until you notice a thin, well distributed film.)

G. Allow solvent to set approximately five minutes

H. Remove solvent from the engine surface

1. If you used a degreaser, apply a strong stream of water

2. If you used a petroleum solvent, remove with a strong soap solution

I. Check for areas that have been missed

J. Remove protective covers

K. Replace carburetor air cleaner

L. Replace blower shroud and cylinder baffles

M. Start engine and operate for three to five minutes

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #2--CLEAN AND INSPECT COOLING SYSTEM

I. Tools and materials

A. Standard screwdrivers, 4" and 6"

B. Phillips screwdrivers, 4" and 6"

C. Socket set

D. Open-end wrench set

E. Wire brush

F. Scraper or putty knife

II. Procedure

A. Close the fuel shut-off valve

(NOTE: Not all engines have shut-off valves. If there is one, it may be either a part of the sediment bowl or a single unit.)

B. Remove fuel tank if necessary for removing the flywheel shroud

C. Remove the recoil starter or screened sheave if equipped with a self-starter

D. Remove the blower shroud

E. Remove remaining baffles and deflectors that direct air from shroud and over end area of cylinder

(NOTE: Do not operate the engine with the shroud and baffles removed.)

F. Clean inside of shroud and baffles with a small bristle brush or a putty knife

G. Clean intake screen by washing in solvent

H. Clean dirt from cylinder fins

I. Clean dirt from blower flywheel fins

J. Inspect engine for cracks, blemishes, and broken parts

K. Reassemble parts in reverse order

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #3--SERVICE OIL-BATH AIR CLEANER

I. Tools and materials

- A. Standard screwdrivers, 4" and 6"
- B. Phillips screwdrivers, 4" and 6"
- C. Container for washing parts
- D. Clean rags
- E. Wooden scraper
- F. Paint brush
- G. Solvent

  (NOTE: Do not use gasoline, naptha, or benzine. They are extremely flammable.)

II. Procedure

- A. Disconnect the spark plug wire
- B. Loosen oil cup or cover and remove the air cleaner
  - 1. Secured by bail wire
  - 2. Secured by wing nut
  - 3. Secured by threaded stud
- C. Cover the exposed air intake
- D. Check depth of sediment deposit in bottom of oil cups
- E. Throw away dirty oil
- F. Clean cup, filter, and other parts with solvents
- G. Check air intake pipe to the carburetor for dirt accumulation
- H. Refill cap with oil to *oil level*
- I. Remove cover from intake
- J. Assemble the air cleaner, install, and tighten
- K. Reconnect the spark plug wire

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #4--SERVICE OIL-FILTER AIR CLEANER

I. Tools and materials

  A. Standard screwdrivers, 4" and 6"

  B. Phillips screwdrivers, 4" and 6"

  C. Container for washing parts

  D. Clean rags

  E. Soap

  F. Paint brush

II. Procedure

  A. Disconnect the spark plug wire

  B. Clean area around air cleaner

  C. Remove filter element cover

  D. Remove filter element

  E. Check condition of the filter element and other parts of the air cleaner

  F. Cover carburetor air intake

  G. Clean filter

  H. Dry filter element

  I. Remove protective cover from the carburetor intake

  J. Clean the carburetor intake

  K. Oil the filter element with a few drops of oil

  L. Install filter element

  M. Install cover

  N. Reconnect spark plug wire

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #5--SERVICE DRY-FILTER AIR CLEANER

I. Tools and materials

  A. Standard screwdrivers, 4" and 6"

  B. Phillips screwdrivers, 4" and 6"

  C. Clean rags

II. Procedure

  A. Disconnect the spark plug wire

  B. Clean the area around the air cleaner

  C. Remove the filter element cover

  D. Remove the air filter element

  E. Cover the carburetor air intake with cloth or plastic

  F. Check condition of filter element and other parts

  G. Clean air filter element

  (NOTE: If filter element is paper, clean by tapping it on a flat surface.)

  (CAUTION: Do not wash it unless instructed to do so by the manufacturer.)

  H. Remove protective cover from the carburetor intake

  I. Clean filter cover and carburetor intake

  J. Replace filter element

  K. Replace cover

  L. Reconnect spark plug wire

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #6--SERVICE SEDIMENT BOWL FUEL STRAINER

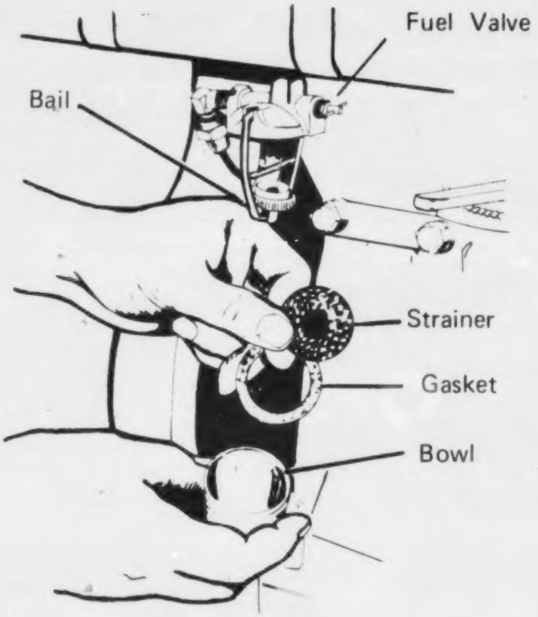
I. Tools and materials

- A. Open-end wrenches, 7/16" and 1/2"
- B. Combination pliers
- C. Solvents
- D. Pan for cleaning parts
- E. Cleaning rags
- F. New gasket for glass bowl
- C. Fire extinguisher

II. Procedure

- A. Disconnect spark plug wire
- B. Close fuel shut-off valve
- C. Loosen jam nut and swing the wire bail to one side (Figure 1)
- D. Remove bowl with a twisting motion (Figure 1)

FIGURE 1



JOB SHEET #6

E. Remove gasket (Figure 1)

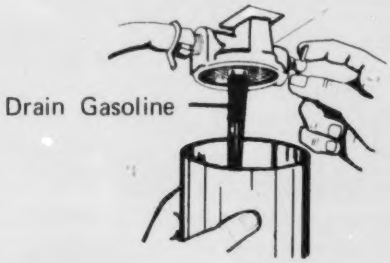
F. Remove strainer (filter) screen (Figure 1)

G. Wash the screen or filter element

H. Clean and then dry sediment bowl

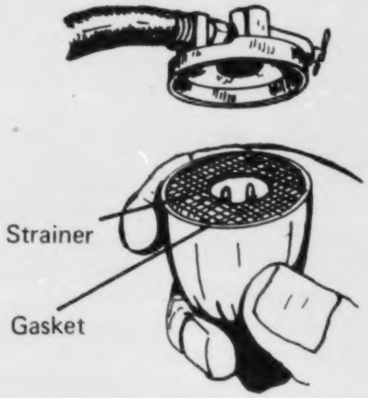
I. Open fuel valve and drain out approximately a cup of fuel (Figure 2) (NOTE: Collect fuel in can to avoid a fire hazard.)

FIGURE 2



J. Install gasket, strainer, and sediment bowl (Figure 3)

FIGURE 3



K. Fill the sediment bowl before tightening the jam nut

L. Tighten bowl against gasket with jam nut

M. Check for leaks before operating engine

N. Reconnect spark plug wire to spark plug

O. Operate engine for a few minutes and recheck for leaks

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #7--SERVICE SCREEN TYPE FUEL STRAINER

I. Tools and materials

- A. Open-end wrenches, 7/16" and 1/2"
- B. Combination pliers
- C. Solvent
- D. Pan for cleaning parts
- E. Cleaning rags
- F. Fire extinguisher

II. Procedure

- A. Disconnect the spark plug wire
- B. Close fuel shut-off valve (if one is installed)
- C. Remove fuel line from tank
- D. Remove fuel shut-off valve and/or fuel strainer from fuel tank if possible
- E. Clean fuel strainer
- F. Replace fuel strainer assembly in reverse order of removal
- G. Reconnect spark plug wire to spark plug

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #8--SERVICE CRANKCASE BREATHER

I. Tools and materials

   A. Open-end wrenches, 7/16" and 1/2"

   B. Standard screwdriver, 8"

   C. Combination pliers

   D. Clean rags

   E. Solvent

   F. Container for cleaning parts

   G. New gasket

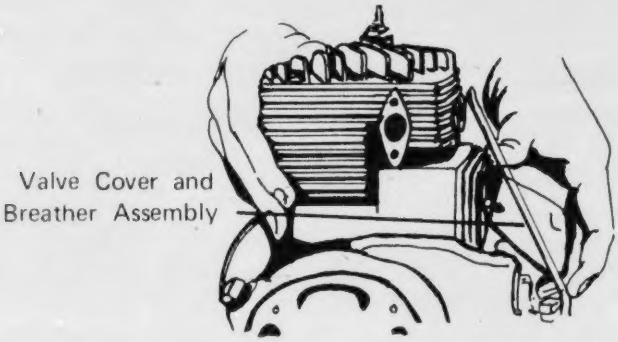
II. Procedure

   A. Disconnect spark plug wire

   B. Check breather for proper operation

   C. Remove crankcase breather cover if installed (Figure 1)

FIGURE 1



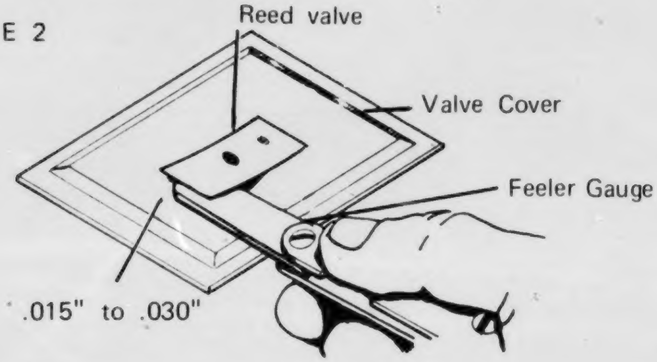
   D. Remove the crankcase breather if it is not a part of the cover

JOB SHEET #8

E. Check breather valve for clearance (Figure 2)

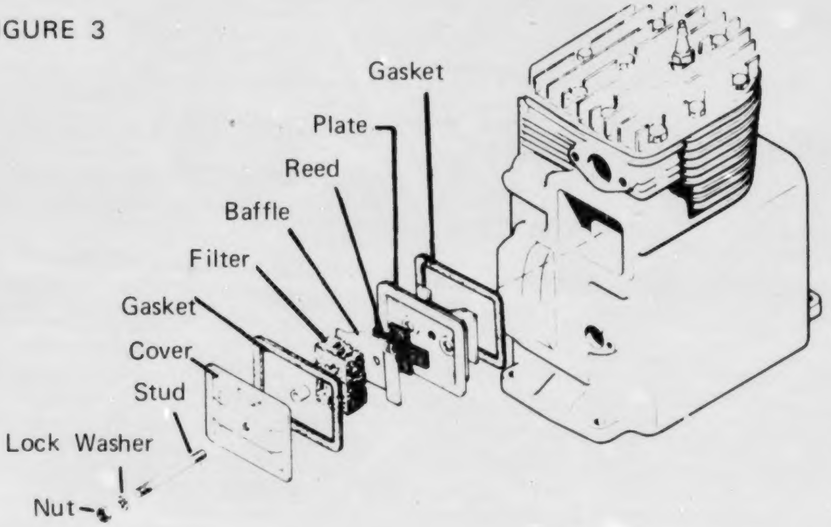
1. Check reed valves with a feeler gauge
2. Be sure clearance is from .015" to .030"

FIGURE 2


Reed valve
Valve Cover
Feeler Gauge
.015" to .030"

F. Disassemble crankcase breather (Figure 3)

FIGURE 3


Gasket
Plate
Reed
Baffle
Filter
Gasket
Cover
Stud
Lock Washer
Nut

G. Clean parts in petroleum solvent

H. Reassemble and install breather

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #9--CHANGE CRANKCASE OIL

I. Tools and materials

   A. Standard screwdriver, 8"

   B. Combination pliers

   C. End wrenches, 7/16", 1/2", 9/16", and 5/8"

   D. Funnel

   E. Oil as recommended

   F. Container for old oil

   G. Clean rags

   H. Fire extinguisher

II. Procedure

   A. Operate engine until it is thoroughly heated

   B. Stop engine and disconnect the spark plug wire

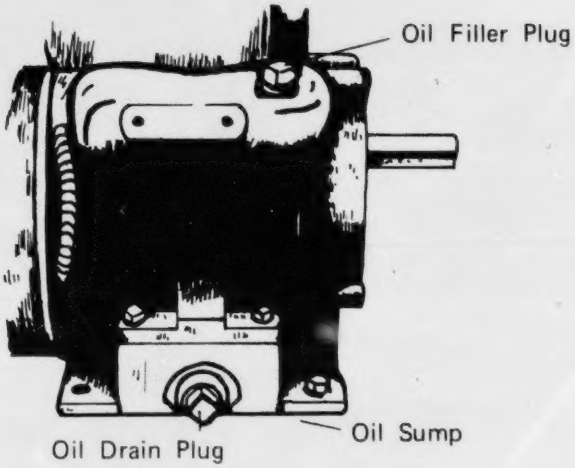
   C. Locate drain plug (Figure 1)

      1. Bottom of oil sump

      2. Under oil sump

      3. Some drained through filler neck

FIGURE 1



JOB SHEET #9

D. Clean dirt from around plug before removing plug

E. Remove drain plug

F. Allow crankcase to drain for approximately five minutes

G. Replace drain plug

H. Refill crankcase with new oil

(NOTE: Use type of oil recommended in the operator's manual.)

I. Connect spark plug wire and start engine

J. Check for oil leaks

K. Stop engine

L. Recheck oil level

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #10--CHECK SPARK PLUG FOR PROPER OPERATION

I. Tools and materials

  A. Spark plug deep sockets, 13/16" x 3/8" and 3/4" x 3/8" drive

  B. Torque wrench, 3/8" drive

  C. Feeler gauge

  D. Ignition file

  E. Pen knife

  F. Wire brush

  G. Small paint brush

  H. Pan of petroleum solvent

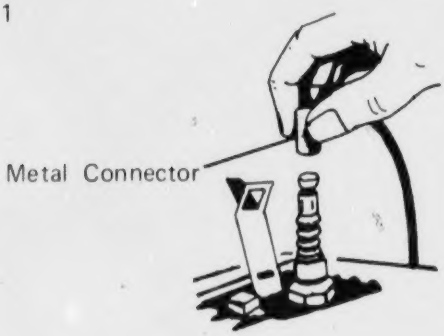
  I. Adjustable gap spark tester

  J. Fire extinguisher

II. Procedure

  A. Disconnect the spark plug wire from the spark plug (Figure 1)

FIGURE 1

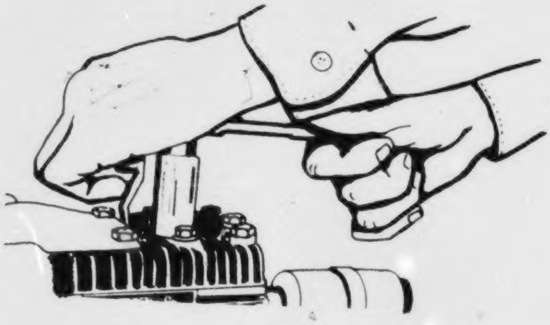


  B. Loosen plug one or two turns and then remove dirt

JOB SHEET #10

C. Remove the spark plug (Figure 2)

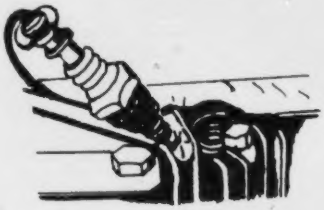
FIGURE 2



D. Reconnect the spark plug wire

E. Ground spark plug to the engine (Figure 3)

FIGURE 3



F. Crank the engine one or two turns

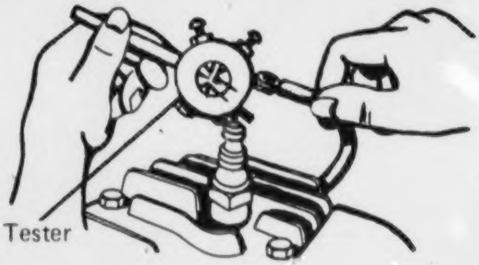
G. Observe the spark at the electrode

(NOTE: If there is no spark or if spark is weak, proceed to next step.)

H. Disconnect the spark plug wire from the spark plug

I. Hold end of the spark plug wire approximately 1/4 inch from the cylinder head or use a spark tester (Figure 4)

FIGURE 4



JOB SHEET #10

J. Crank the engine one or two turns

K. Observe the spark between spark plug wire and the cylinder head

(NOTE: If the spark is blue-orange color, the ignition system is okay; the trouble is in the spark plug.)

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #11--CLEAN AND SERVICE SPARK PLUGS

I. Tools and materials

   A. Spark plug deep sockets, 13/16" x 3/8" and 3/4" x 3/8" drive

   B. Torque wrench, 3/8" drive

   C. Feeler gauge

   D. Ignition file

   E. Pen knife

   F. Wire brush

   G. Small paint brush

   H. Pan of petroleum solvent

   I. Fire extinguisher

II. Procedure

   A. Check the condition of the plugs

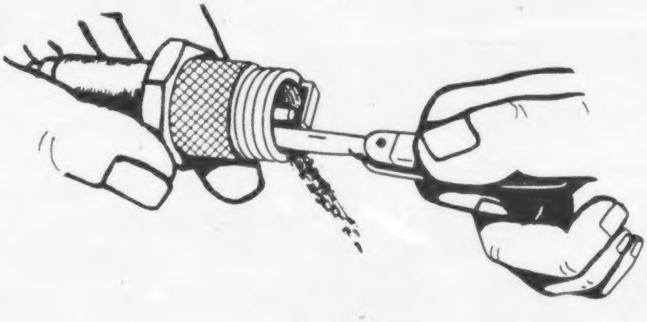
   B. Remove oil deposits from plugs

   C. Clean threads with wire brush

   (NOTE: Do not brush the insulator. It will leave a metallic film which may provide an electrical short to ground.)

   D. Remove deposits from plugs (Figure 1)

FIGURE 1



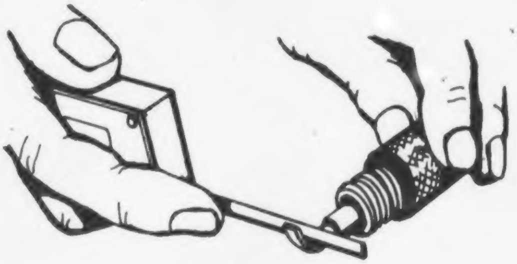
JOB SHEET #11

E. Blow loose materials from plug with compressed air

F. Bend the ground electrode enough to allow room for a thin point file (Figure 2)

(NOTE: Bend just enough to allow room for file. Too much bending will break the ground electrode.)

FIGURE 2



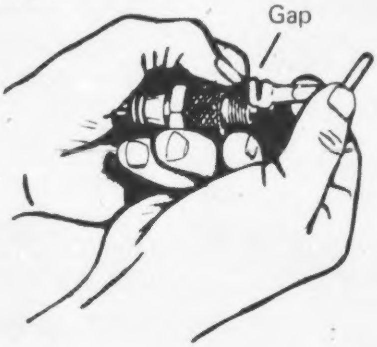
G. File electrodes on plugs until both have flat surfaces (Figure 2)

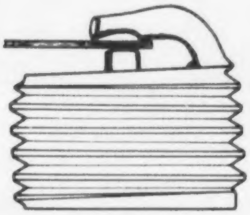
H. Bend the ground electrode back into its original position

I. Determine proper spark gap spacing for your engine (Figure 3)

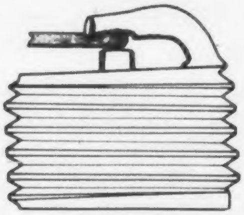
1. Most plugs set on .025 inch
2. Range from .020" to .040"

FIGURE 3





Wrong



Right

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #12--REPLACE IGNITION CONTACT POINTS AND CONDENSER ON INTERNAL MAGNETO

I. Tools and materials

A. Socket set, 3/8" drive

B. Combination wrench set

C. Standard screwdriver

D. Soft hammer

E. Flywheel holding tool

F. Flywheel puller

G. Fire extinguisher

H. Feeler guage

II. Procedure

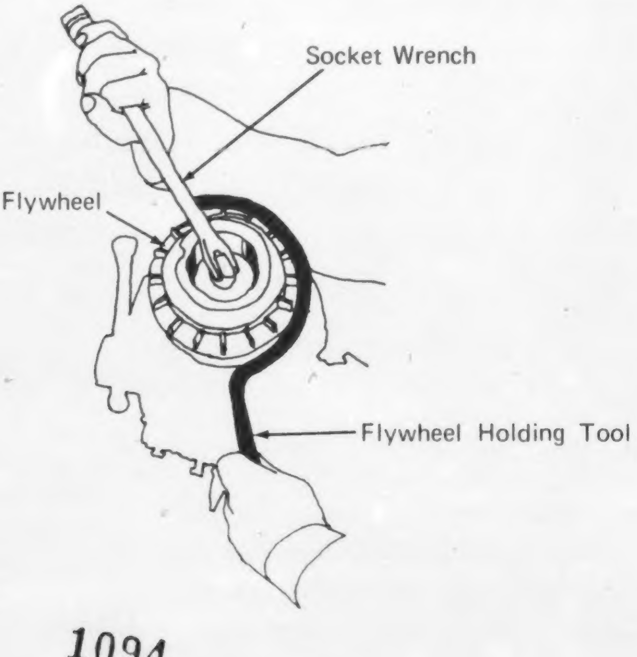
A. Disconnect spark plug wire

B. Disconnect fuel line

C. Remove flywheel shroud and fuel tank; rewind starter

D. Remove flywheel nut (Figure 1)

FIGURE 1



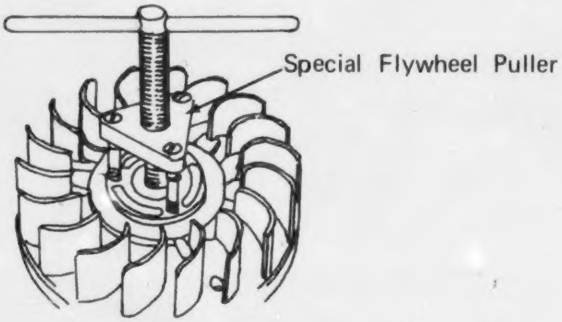
JOB SHEET #12

E. Remove the flywheel by one of these two methods

1. Attach flywheel puller and remove flywheel (Figure 2)

   (NOTE: Care should be taken not to damage the crankshaft threads.)

FIGURE 2


Special Flywheel Puller

2. Remove flywheel from a tapered shaft only (Figure 3)

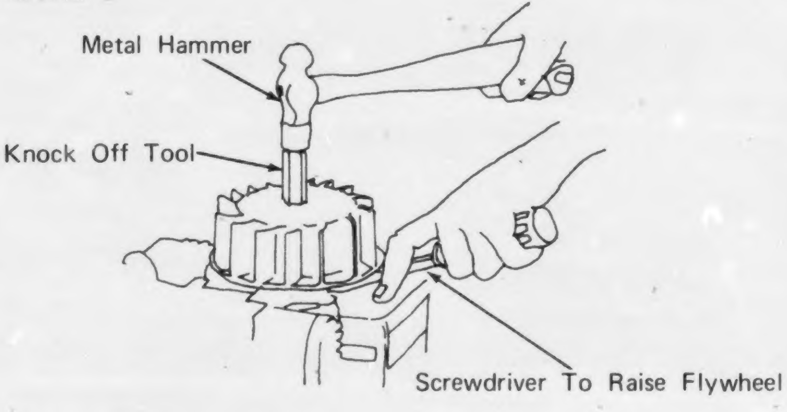
   a. Place knock-off tool on end of crankshaft

   b. Hold pressure on flywheel by hand or pry it

   c. Strike end of knock-off tool with a sharp blow

   (NOTE: Do not strike the knock-off tool more than three to four times because it could knock the magnetism out of the flywheel.)

FIGURE 3


Metal Hammer
Knock Off Tool
Screwdriver To Raise Flywheel

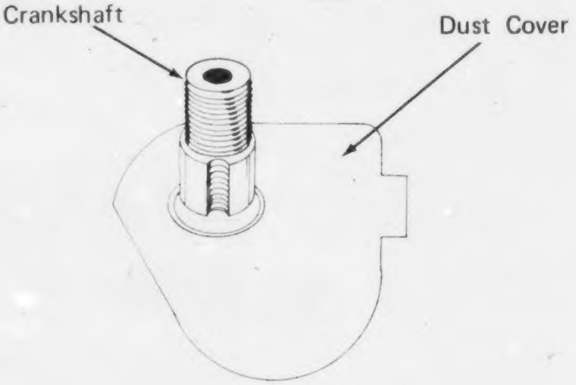
JOB SHEET #12

F. Clean the area of the engine covered by the flywheel

G. Remove the ignition dust cover (Figure 4)

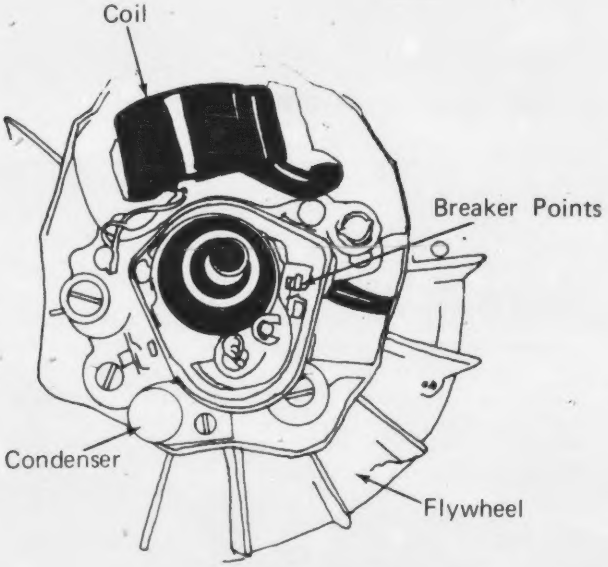
(NOTE: On some models it will be necessary to remove the centrifugal spark advance mechanism before removing the dust cover.)

FIGURE 4


Crankshaft
Dust Cover

H. Remove the points and condenser (Figure 5)

FIGURE 5


Coil
Breaker Points
Condenser
Flywheel

JOB SHEET #12

I. Inspect the crankshaft seal for oil leaks

J. Check for worn crankshaft bearings

K. Inspect the point cam area on the crankshaft

L. Inspect the ignition switch wire for proper insulation and proper routing

(NOTE: Some machinery is equipped with a safety shut-off switch that needs to be inspected for proper operation.)

M. Inspect the magneto coil for

1. Good ground connection
2. Insulation for cracks or overheated spots
3. Spark plug wire insulation and proper routing

N. Inspect the flywheel for

1. Keyway condition (Figure 6)
2. Key condition (Figure 6)

(NOTE: A partially sheared key or enlarged keyway will cause a weak ignition spark. See Figure 7.)

FIGURE 6

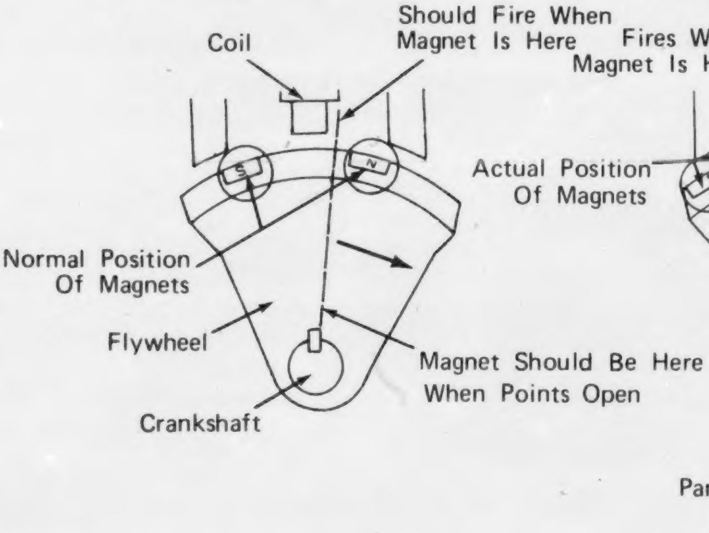
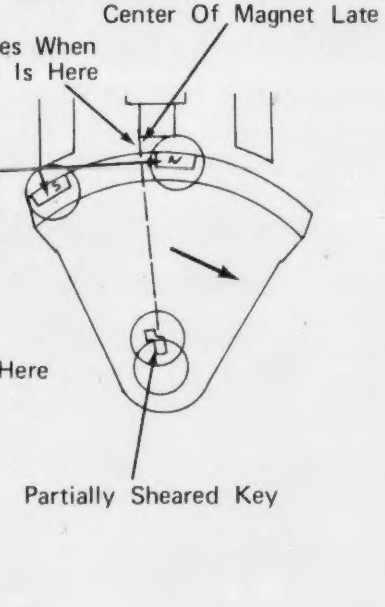

Coil
Should Fire When Magnet Is Here
S
N
Normal Position Of Magnets
Flywheel
Magnet Should Be Here When Points Open
Crankshaft

FIGURE 7


Center Of Magnet Late
Fires When Magnet Is Here
Actual Position Of Magnets
S
N
Partially Sheared Key

JOB SHEET #12

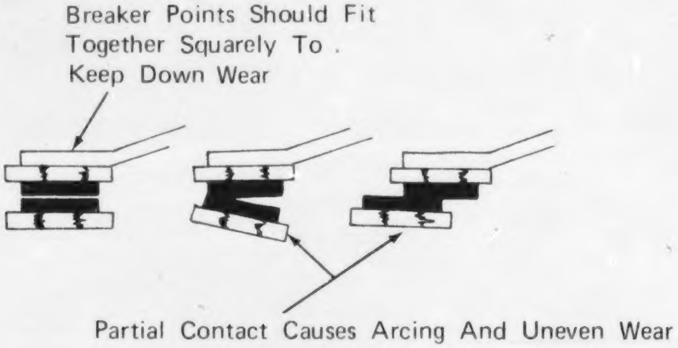
  3. Interference with the coil armature
  4. Strong magnetic pull

O. Install the ignition points and condenser

P. Lubricate the point rubbing block

Q. Align contact surfaces on points (Figure 8)

FIGURE 8

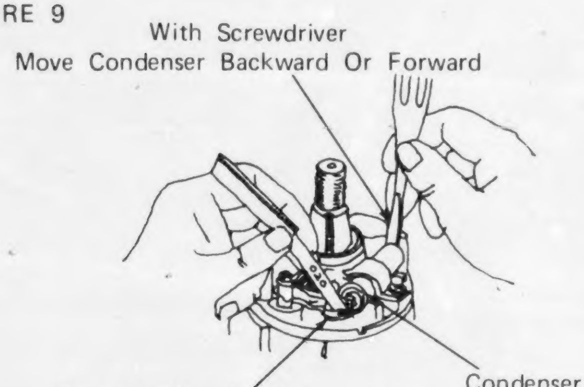

Breaker Points Should Fit Together Squarely To Keep Down Wear
Partial Contact Causes Arcing And Uneven Wear

R. Turn the crankshaft in the direction of normal rotation until cam opens breaker points to the widest position

S. Adjust the point gap

  1. Loosen condenser clamp and move condenser to adjust gap (Figure 9)

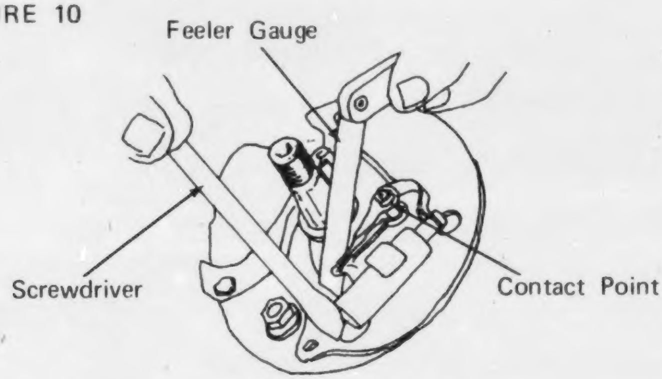
FIGURE 9


With Screwdriver Move Condenser Backward Or Forward
Contact Point Bracket
Condenser

JOB SHEET #12

2. Loosen retaining screw on stationary point just enough to slide point on breaker plate to adjust gap (Figure 10)

FIGURE 10


Feeler Gauge
Screwdriver
Contact Point

T. Rotate the crankshaft four or five turns and watch point for proper operation

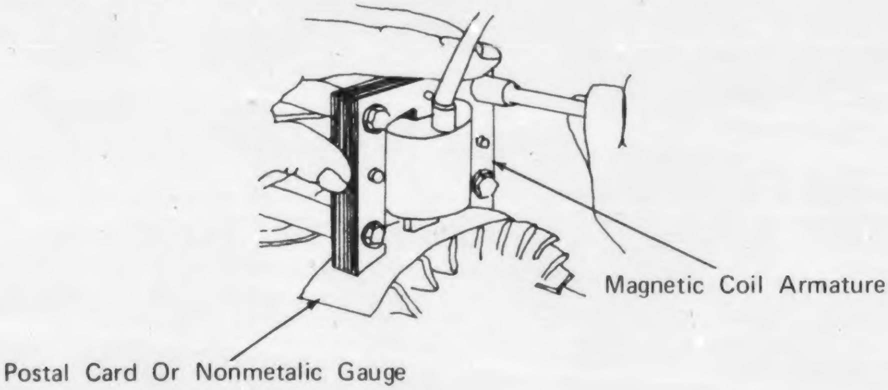
U. Install ignition dust cover and ignition advance mechanism if so equipped

V. Install flywheel and torque the retaining nut

W. Adjust the magneto armature air gap to .005" - .010"

(NOTE: A postal card is a good gauge to use for this adjustment. See Figure 11.)

FIGURE 11


Magnetic Coil Armature
Postal Card Or Nonmetalic Gauge

JOB SHEET #12

X. Replace flywheel shroud, fuel tank, and rewind starter assembly

Y. Connect fuel line

Z. Connect spark plug wire

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #13--REPLACE IGNITION CONTACT POINTS AND CONDENSER ON EXTERNAL MAGNETO

I. Tools and materials

   A. Socket set, 3/8" drive

   B. Combination wrench set

   C. Standard screwdriver

   D. Timing light

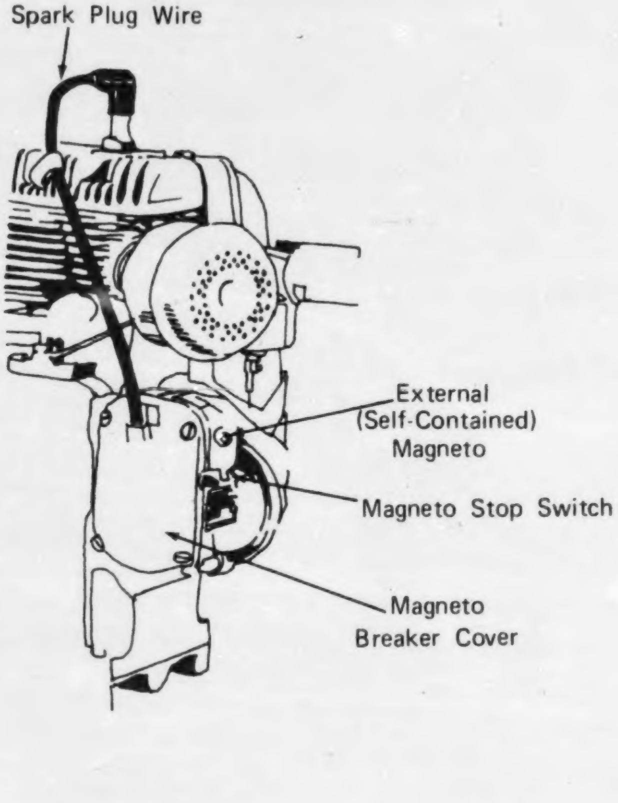
   E. Fire extinguisher

   F. Feeler guage

II. Procedure

   A. Remove any equipment or engine accessories necessary to allow easy access to the magneto (Figure 1)

FIGURE 1


Spark Plug Wire
External (Self-Contained) Magneto
Magneto Stop Switch
Magneto Breaker Cover

JOB SHEET #13

B. Clean magneto breaker cover and some working area around it (Figure 1)

C. Remove the breaker cover

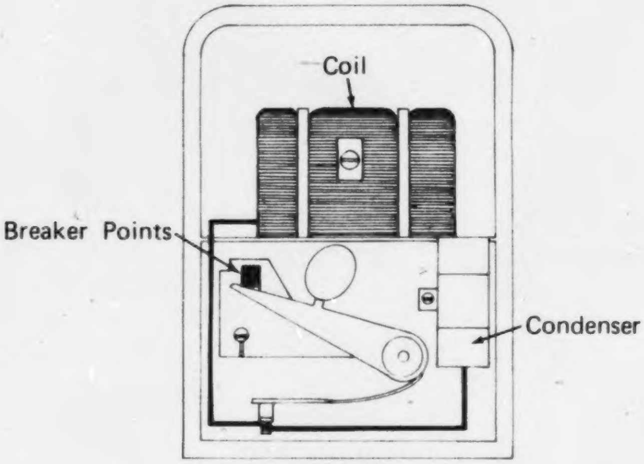
D. Clean and inspect the cover for cracks, spark paths, and a good seal to magneto case

E. Inspect the spark plug wire connections and insulation

(NOTE: Use a continuity light to test wire connections.)

F. Remove breaker points and condenser (Figure 2)

FIGURE 2



G. Clean the inside of the magneto

H. Lubricate the breaker cam

I. Install the new breaker points and condenser (Figure 2)

J. Rotate the engine in the normal direction of operation until the breaker points are open to the widest position

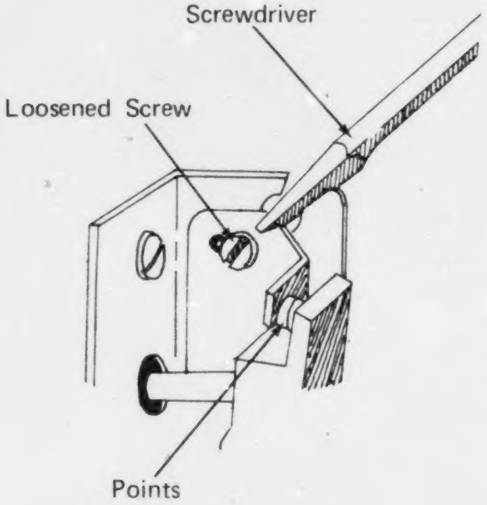
JOB SHEET #13

K. Adjust breaker point gap

1. Loosen the point retaining screw just enough to enable the stationary point to be moved by prying but maintain its position until adjustment is completed

2. Gauge and adjust the distance between the two breaker points with a wire feeler gauge so that the gauge has a very light drag and the movable point does not move when the gauge is pulled out (Figure 3)

FIGURE 3



3. Retighten the retaining screw

4. Rotate the engine several times and recheck the breaker point gap

L. Replace the magneto cover

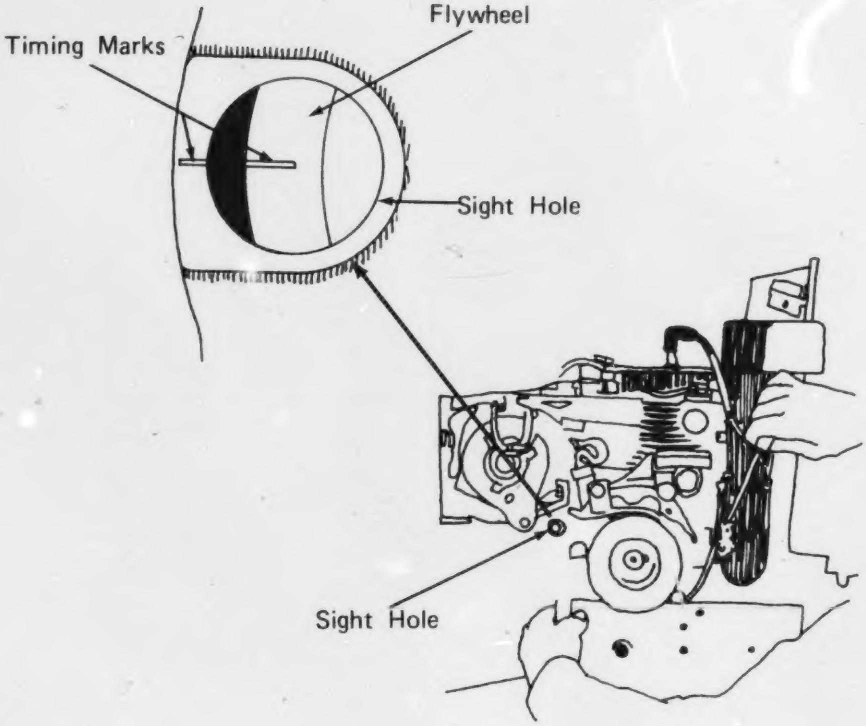
(NOTE: Be sure the cover makes a good seal with the magneto case so it will seal against dirt and moisture.)

JOB SHEET #13

M. Time the magneto to the engine

1. Connect the heavy insulated lead of the timing light in series with the spark plug wire (Figure 4)
2. Connect primary leads to battery posts or to twelve volt supply
3. Locate the timing marks and clean so they can be easily seen (Figure 4)

FIGURE 4

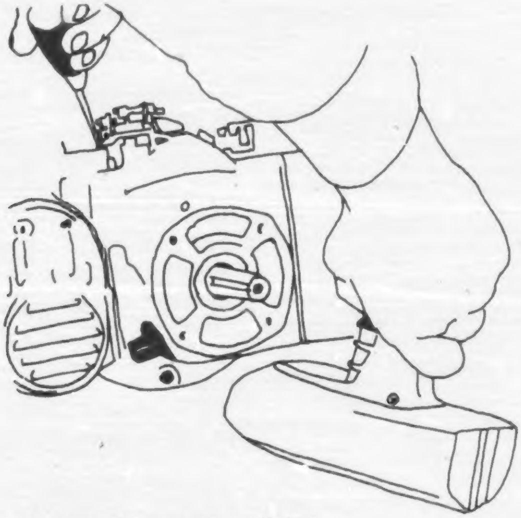

Flywheel
Timing Marks
Sight Hole
Sight Hole

4. Start the engine and adjust the idle to approximately 1,000 rpm

JOB SHEET #13

5. Hold the timing light so that it will flash on the timing marks (Figure 5)

FIGURE 5



6. Loosen the magneto attaching bolts slightly

7. Rotate the magneto case in either direction until the timing marks align and retighten the attaching bolts

   (NOTE: If the timing cannot be set correctly by rotating the magneto it will be necessary to readjust the points until the timing marks align.)

8. Disconnect the timing light

N. Replace any equipment or engine accessories removed to allow access to the magneto

SERVICING SMALL ENGINES
UNIT II

JOB SHEET #14--SERVICE FLOAT TYPE CARBURETOR

I. Tools and materials

  A. Combination wrench set

  B. Socket set, 3/8" drive

  C. Standard screwdriver set

  D. Phillips screwdriver set

  E. Needlenose pliers

  F. Steel ruler, 6"

  G. Suitable carburetor cleaning fluid

  H. Parts cleaning basket

  I. Fire extinguisher

II. Procedure

  A. Close fuel shut-off valve

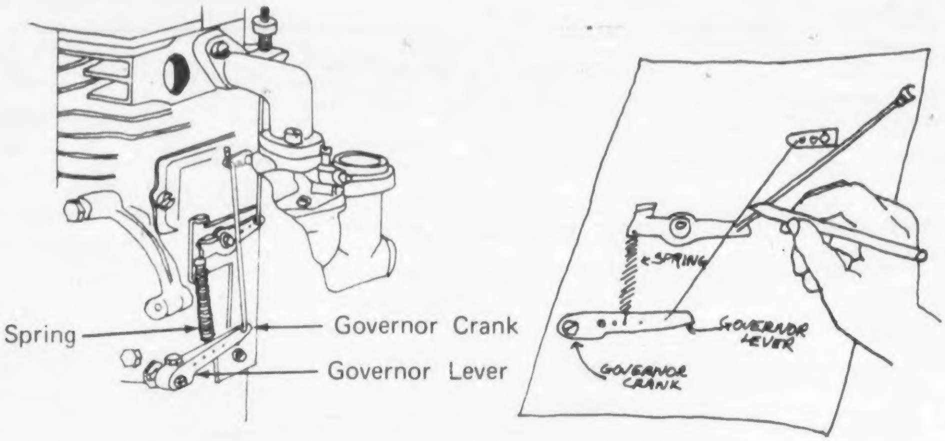
  B. Disconnect fuel line

  C. Disconnect throttle and choke cable

  D. Disconnect governor linkage

  (NOTE: It is recommended that you make a sketch of the linkages and their positions to aid reassembly. See Figure 1.)

FIGURE 1

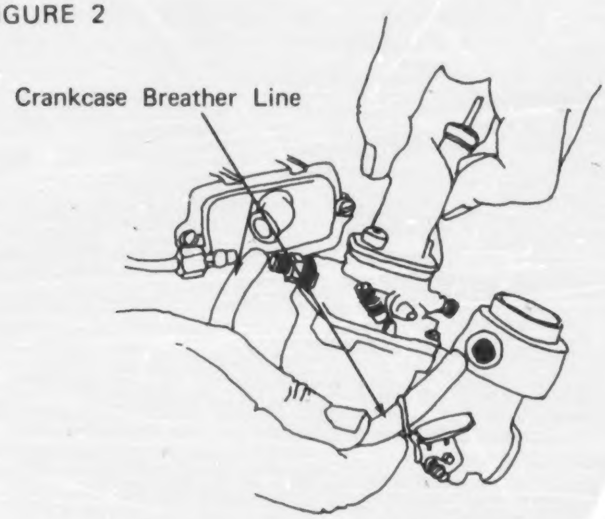

Spring
Governor Crank
Governor Lever
SPRING
GOVERNOR LEVER
GOVERNOR CRANK

JOB SHEET #14

E. Remove the carburetor

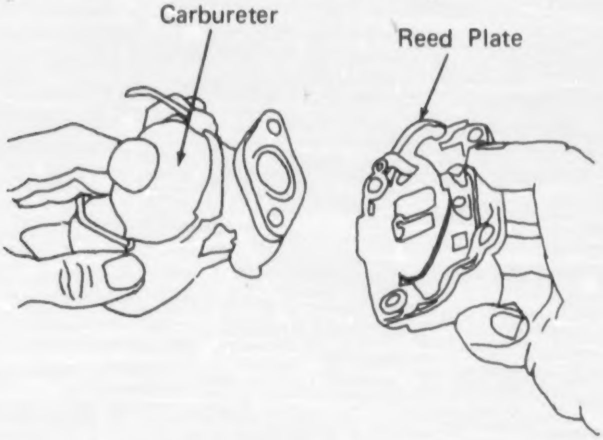
(NOTE: Some models have a breather return hose to disconnect. See Figure 2.)

FIGURE 2


Crankcase Breather Line

F. Remove the intake valve plate from the carburetor on some two-cycle engines (Figure 3)

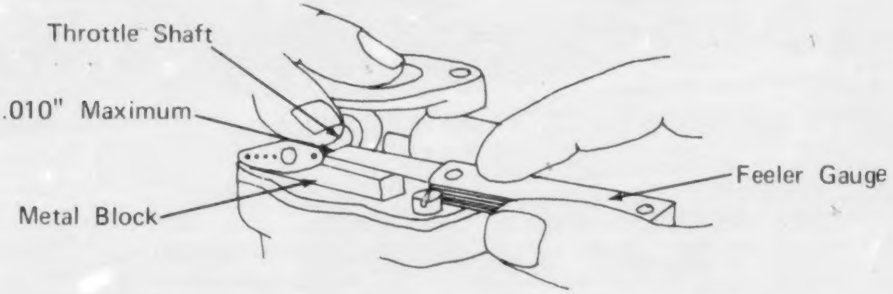
FIGURE 3


Carbureter
Reed Plate

JOB SHEET #14

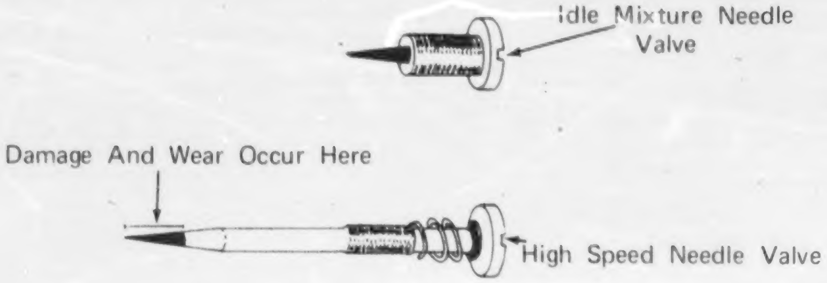
G. Check throttle shaft bushing for wear (Figure 4)

FIGURE 4


Throttle Shaft
.010" Maximum
Metal Block
Feeler Gauge

H. Remove and check the condition of the high speed and idle speed needle valves (Figure 5)

FIGURE 5

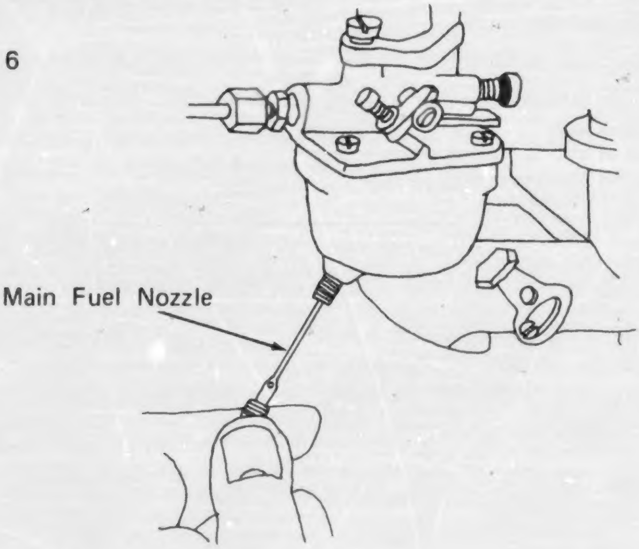

Idle Mixture Needle Valve
Damage And Wear Occur Here
High Speed Needle Valve

JOB SHEET #14

I. Remove the float bowl

(NOTE: On two piece carburetors remove the main fuel nozzle before removing float bowl. See Figure 6.)

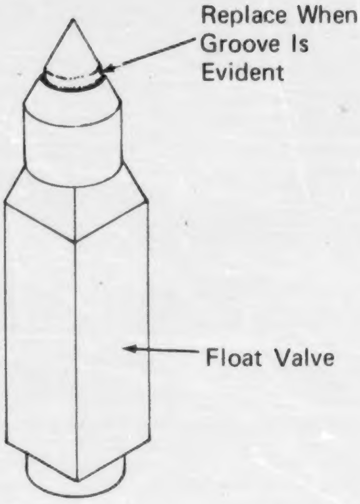
FIGURE 6


Main Fuel Nozzle

J. Remove float hinge pin and remove float

K. Remove float valve and inspect for wear; replace if a groove is worn in the tapered point of the valve (Figure 7)

FIGURE 7

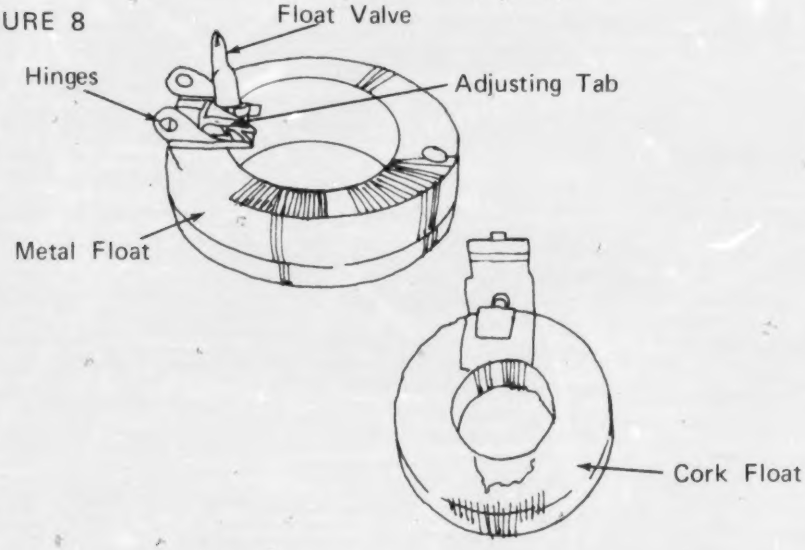

Replace When Groove Is Evident
Float Valve

JOB SHEET #14

L. Inspect the floats for

1. Worn hinges
2. Fuel in metal floats; replace if you feel a liquid inside the float
3. Good varnish coating on cork floats; replace the float if the varnish is pealing or has been punched (Figure 8)

FIGURE 8



M. Remove all gaskets and/or rubber parts on the carburetor

N. Place all the carburetor parts except the gaskets, float, and rubber parts in a cleaner basket

O. Place the basket in the carburetor cleaner and gently move it up and down to circulate the cleaner through the parts; then let it set for approximately one hour

P. Remove the basket from the cleaner

Q. Rinse the parts and basket thoroughly with water

R. Dry the parts, one at a time, with compressed air

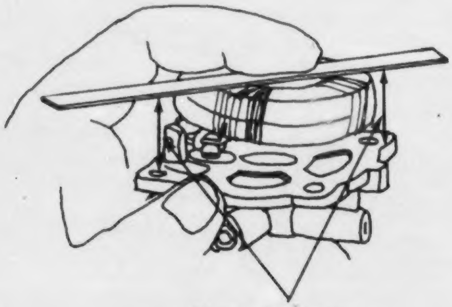
(NOTE: Be sure to blow out all passages in the carburetor body.)

S. Replace float valve and float on the carburetor body

JOB SHEET #14

T. Adjust the float level by bending the tab and measuring correct height with a steel ruler (Figure 9)

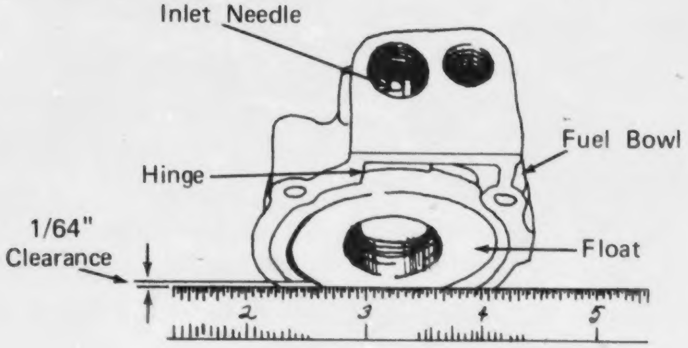
FIGURE 9



Same Distance

U. Check distance from carburetor to float top for proper height and equal distance on horizontal float (Figure 10)

FIGURE 10

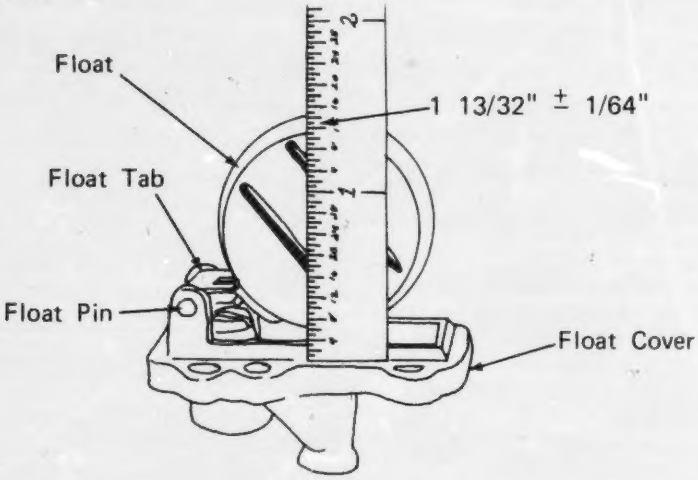

Inlet Needle
Fuel Bowl
Hinge
1/64" Clearance
Float
2
3
4
5

JOB SHEET #14

V. Check distance on a vertical float from carburetor top to top of float

(NOTE: Float should be true vertical to the carburetor top to prevent interference with float bowl walls. See Figure 11.)

FIGURE 11



W. Check bottom of float for proper clearance in relation to float bowl

X. Install new float bowl gasket and attach bowl to carburetor top

Y. Install idle mixture valve and screw it down until it is lightly seated; then back it out approximately two turns

(NOTE: Install the main fuel nozzle on the two-piece carburetor.)

Z. Install the high speed valve and screw it down until it is lightly seated; then back it out approximately two turns

(NOTE: Steps Y and Z are preliminary adjustments only and will be completed with the engine running.)

AA. Check for free operation of the throttle and choke valve

BB. Install the carburetor on the engine

CC. Reconnect the governor linkage according to the diagram sketched earlier

DD. Reconnect throttle and choke linkage

JOB SHEET #14

EE. Reconnect fuel line

FF. Open fuel shut-off valve and watch float bowl area of the carburetor for fuel leaks

(NOTE: Occasionally the float valve will get contamination in it that will keep it from shutting off. In this case, a few light taps on the valve area will release the contamination and solve the problem.)

GG. Start the engine and operate until it is at normal operating temperature

HH. Adjust idle speed

II. Adjust the idle mixture valve to the highest and smoothest rpm at idle speed

(NOTE: It may be necessary to reset the idle speed again.)

JJ. Accelerate the engine up to governor controlled rpm and adjust high speed valve to highest and smoothest rpm

SERVICING SMALL ENGINES
UNIT II

TEST

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Device located in the manifold which controls the fuel and air

______b. Gate or valve which allows passage of gas or fluid in one direction only

______c. Space between the electrodes of a spark plug through which the spark jumps

______d. Hammering force on the piston rather than a uniform pushing force

______e. Device for filtering, cleaning, and removing dust from the air admitted to a unit, such as an engine

______f. Device for automatically mixing fuel in the proper proportion with air to produce a combustible gas

______g. Alternator with permanent magnets used to generate current for the ignition in an internal combustion engine

______h. Pair of points, one stationary and the other operated by a cam, to make and break the primary ignition circuit usually made of tungston, platinum, or silver

______i. Device for temporarily collecting and storing a surge of electrical current for later discharge

1. Condenser
2. Magneto
3. Air cleaner
4. Butterfly (throttle) valve
5. Spark gap
6. Choke valve
7. Ignition contact points (breaker points)
8. Detonation or knock
9. Carburetor

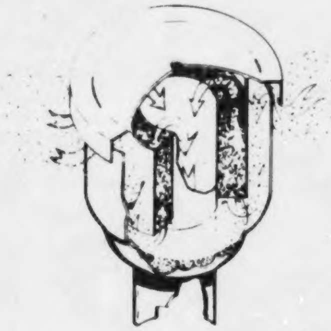
2. Name three solutions used in cleaning an engine.

a.

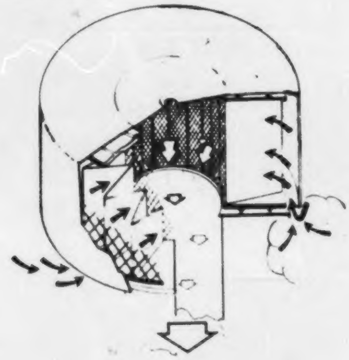
b.

c.

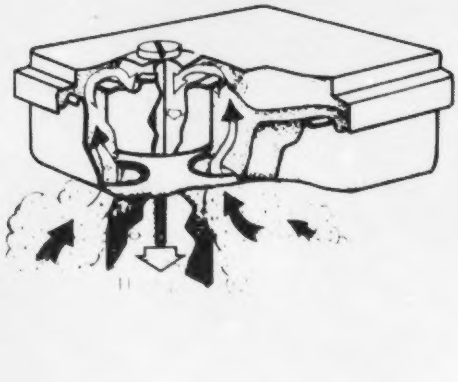
3. Identify the following types of air cleaners by writing the appropriate names in the blanks provided.



a.______________________________

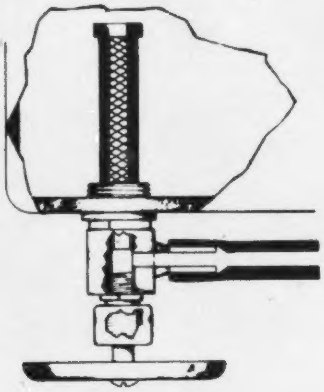


b.______________________________

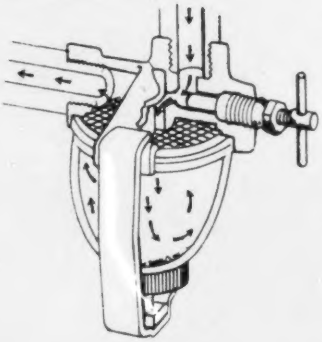


c.______________________________

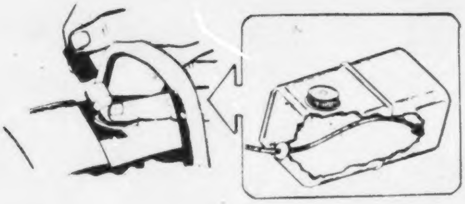
4. Identify the following types of fuel filters.



a.____

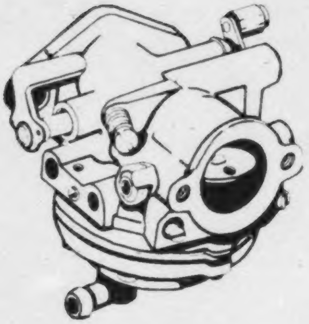


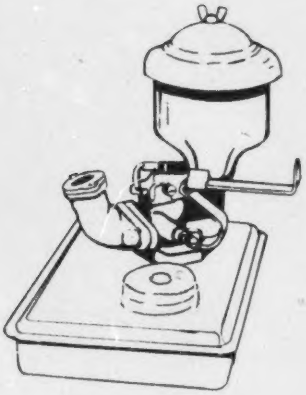
b.____



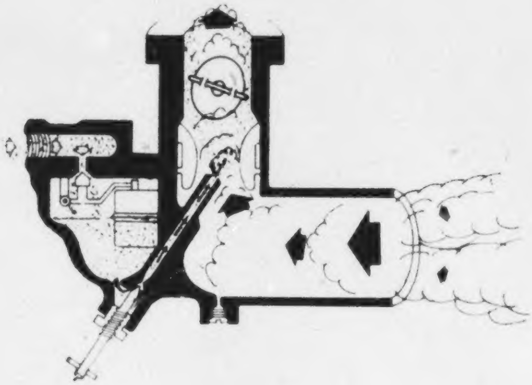
c.____

5. Identify the following types of carburetors.



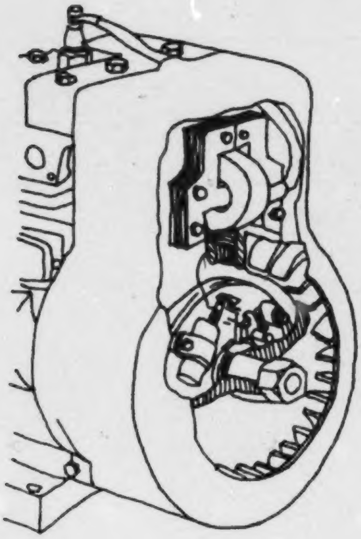


a.____________________________ b.____________________________

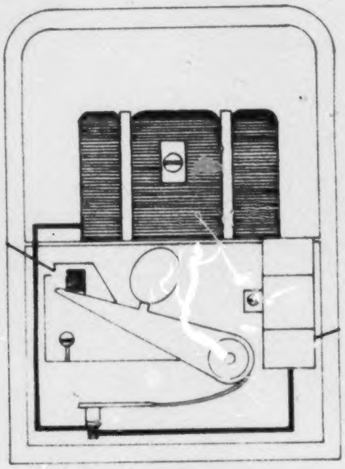


c.____________________________

6. Identify the following types of magnetos.



a. ____________________________



b. ____________________________

7. Demonstrate the ability to:
   - a. Clean and inspect crankcase and accessories.
   - b. Clean and inspect cooling system.
   - c. Service oil-bath air cleaner.
   - d. Service oil-filter air cleaner.
   - e. Service dry-filter air cleaner.
   - f. Service sediment bowl fuel strainer.
   - g. Service screen type fuel strainer.
   - h. Service crankcase breather.
   - i. Change crankcase oil.
   - j. Check spark plug for proper operation.
   - k. Clean and service spark plugs.
   - l. Replace ignition contact points and condenser on internal magneto.
   - m. Replace ignition contact points and condenser on external magneto.
   - n. Service float type carburetor.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SERVICING SMALL ENGINES
UNIT II

ANSWERS TO TEST

1. a. 4
   b. 6
   c. 5
   d. 8
   e. 3
   f. 9
   g. 2
   h. 7
   i. 1

2. a. Commercial solvent
   b. Petroleum solvents
      1) Kerosene
      2) Diesel fuel
   c. Live steam

3. a. Oil-bath
   b. Dry-filter
   c. Oiled-filter

4. a. Screen in fuel tank
   b. Combination screen and sediment bowl
   c. Strainer on fuel pick-up hose

5. a. Diaphragm
   b. Suction-lift
   c. Float

6. a. Internal (flywheel) magneto
   b. External magneto

7. Performance skills evaluated to the satisfaction of the instructor

CEMENT MASON'S

PROGRESS CHART

Section J
Equipment Repair

Job	UNIT I Small Engine Operation				UNIT II Servicing Small Engines															
	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Student's Name	UNIT TEST	Disassemble Small Gasoline Engine	Reassemble Small Gasoline Engine		UNIT TEST	Clean and Inspect Crankcase and Accessories	Clean and Inspect Cooling System	Service Oil-Bath Air Cleaner	Service Oil-Filter Air Cleaner	Service Dry-Filter Air Cleaner	Service Sediment Bowl Fuel Strainer	Service Screen-Type Fuel Strainer	Service Crankcase Breather	Change Crankcase Oil	Check Spark Plug for Proper Operation	Clean and Service Spark Plugs	Replace Ignition Contact Points and Condenser on Internal Magneto	Replace Ignition Contact Points and Condenser on External Magneto	Service Float Type Carburetor	
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct				85% Correct							Openings in Screen Must be Clean	Openings in Screen Must be Clean			Insulation Clean and not Broken ± .002 gap setting	± .002 gap setting	± .002 gap setting		
8																				
9																				
10																				
11																				
12																				
13																				
14																				
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